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THE FOCAL SPOT

CANADIAN SOCIETY OF RADIOLOGICAL TECHNICIANS
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News Items from the Provinces

ALBERTA SOCIETY OF RADIOLOGICAL TECHNICIANS

CALGARY SECTION

The Calgary Society is proud to report that their study groups are progressing successfully. After one or two interruptions, we were able to cary on a short but fruitful series of lectures by Dr. Florendine, on the physics and therapeutic value of x-rays. One interruption to this series, was a week of classes, held each afternoon and evening for the benefit of those technicians and would-be technicians in Central Alberta, who wished to attend. These classes were sponsored by the Victor X-Ray Corporation, having as their lecturers, Mr. Ken Hall of Toronto, and Mr. Alf Flowers of Edmonton.

As the Calgary x-ray departments were still operating, only one or two technicians were free for the afternoon sessions, but the evening programme was taken in by many of them. In all, there were over thirty persons attending the classes.

Although one week seems almost too short a time to gather information, much was gained by each one present, for during and after each class, questions and problems were brought up and solved. The afternoon classes, held in the Holy Cross Hospital, were in the form of lectures, whereas the evenings were spent in practical work at the office of Dr. W. W. McGuffin.

Another highlight for the Calgary Society was the annual banquet and not-so-annual dance, held December 18th, and attended by over fifty members, friends and Radiologists. During the course of the dinner, a flaming plum pudding was piped in under the hardy piping of our own Bert Welch, and borne by Dr. Quint.

Following the dinner a presentation was made by Mrs. McIntyre, on behalf of the Calgary technicians, to Mr. Welch, of a Life Membership in our local society.

As this function brought to a close another year for the society, the officers for the coming year have been elected, with the following results:

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May you have every success during the coming year, fellow technicians.

News Items from the Provinces

BRITISH COLUMBIA SOCIETY OF X-RAY TECHNICIANS

The meeting held on November 14th, at St. Paul's Hospital was attended by nearly forty members. We were very fortunate in having Dr. C. W. Prowd, one of Canada's best known Radiologists, give an address on "X-Ray Therapy." This proved to be a most instructive and interesting topic and the hearty vote of thanks accorded to Dr. Prowd was well merited. After the meeting refreshments were served as usual and Dr. Prowd continued to answer many questions during this period.

The Annual Meeting and Election of Officers for 1947 was held on December 12th. The results are as follows:

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In order to create a change from usual meetings the President held a Quiz Contest which proved to be the source of a lot of pleasure and merriment. Prizes were given for the best answers and were won by Miss M. McMillan and Mr. Bill Osborne. This is evidence that the Wise Men do come from the East. Refreshments were served after the meeting and everyone who attended seemed to have a good time. Unfortunately there were only a few members who braved the elements to attend.

"HEAR" AND THERE

Congratulations to Mrs. D. McLeod, formerly a member of our society in the person of Miss M. Stordy, on the birth of a son in Calgary recently.

Picking a President is no trouble to our members. One would think a society would like to show some improvement from year to year. Where DO members go on meeting nights?

Have not heard of any romances budding into engagements or marriages lately.

The officers and members of the B. C. Society extend to all members of the Society from coast to coast Best Wishes for a Happy and Prosperous New Year.

—W. Q. STIRLING, R.T.,
President.

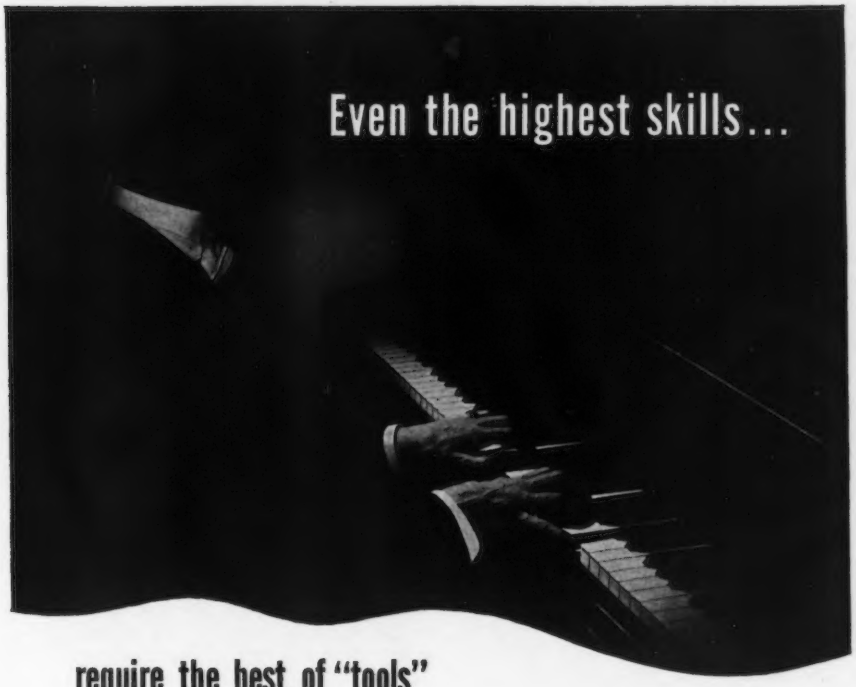
MANITOBA SOCIETY OF X-RAY TECHNICIANS

During the October meeting of the Manitoba Society of X-Ray Technicians it was decided that a monthly news bulletin be prepared by the sub-editor and sent out to the out of-town members. The bulletin is entitled " K.V.P. News" and it carries the news of the society's activities. The appreciative replies from out-of-town members were very gratifying.

The November meeting of the Manitoba Society was held at the Winnipeg Clinic, November 20th, at 8 p.m. The attendance was very good.

After the business meeting there was a Round Table discussion on the Physics part of the last Canadian Society of Radiological Technicians paper.

After adjournment some of the members who had not seen the Clinic were escorted through by the young ladies of the Winnipeg Clinic X-Ray staff.



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News Items from the Provinces

The December meeting was held in the Board Room of the Winnipeg General Hospital on Wednesday, December 11th, at 8 p.m.

An interesting paper, sent in by Arthur Cliffe of Clearwater Lake Hospital, The Pas, Manitoba, was read by Mr. G. Axtell. The paper was entitled "My Work Up Here." It dealt with the experiences of the travelling clinic by aeroplane, car, and dog sleds in Northern Manitoba.

The main business of the meeting was the election of officers for the 1947 season. The new officers are as follows:

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Miss Betty Mark, Winnipeg Clinic, was appointed Sub-Editor for The Focal Spot for 1947. Miss C. Hopper, Winnipeg Clinic, was appointed Chairman of the Program Committee for the coming season.

Other news from Manitoba: The Manitoba Clinic, formerly the "Dr. McCharles Surgical Clinic," Medical Arts Building, has a brand new x-ray department. Mrs. M. Carlson, is in charge. Congratulations and the best of luck, Mrs. Carlson.

The Winnipeg General Hospital X-Ray Department has a complete installation of new equipment. Their department is one to be proud of.

—M. STESKI, R.T.,
Sub-Editor.

NEW BRUNSWICK SOCIETY OF X-RAY TECHNICIANS

A regular meeting of the New Brunswick Society of X-Ray Technicians was held at the Moncton Hospital, at eight o'clock on October 26th, 1946. The President, Miss Katherine Creelman, occupied the chair. There were eight members and two guests present.

There was a departure from the usual order of business in order to give the members an opportunity to hear an outstanding radiologist and educationist, Dr. Jules Gosselin, of Quebec. Dr. Gosselin, who has spent a number of years overseas in the armed forces, is now a valued consultant in the Department of Radiology in D.V.A. hospitals. It is his aim to raise the educational standards of x-ray technicians, primarily those connected with D.V.A. staffs and eventually to standardize the requirements of x-ray technicians in general. A discussion followed Dr. Gosselin's talk, when the members were free to ask questions.

Dr. H. R. Ripley, Radiologist to the Moncton Hospital, presented a well prepared instruction on "Radiography of the Temporal Bone." Excellent films were shown through out the lecture; also types of apparatus used and positioning of the head required to bring about such good results.

During the business meeting, Dr. E. A. Petrie, Chairman of the Examining Board, presented a report pertaining especially to regulations governing applications for examinations in the future, an outcome of the Annual Meeting in Niagara. Dr. Petrot gave us a few highlights of the Niagara convention and expressed his pleasure in meeting so many technicians from across Canada who are giving their time and talent to assist the Canadian Society as a whole as well as their own member societies.

continued on page 45

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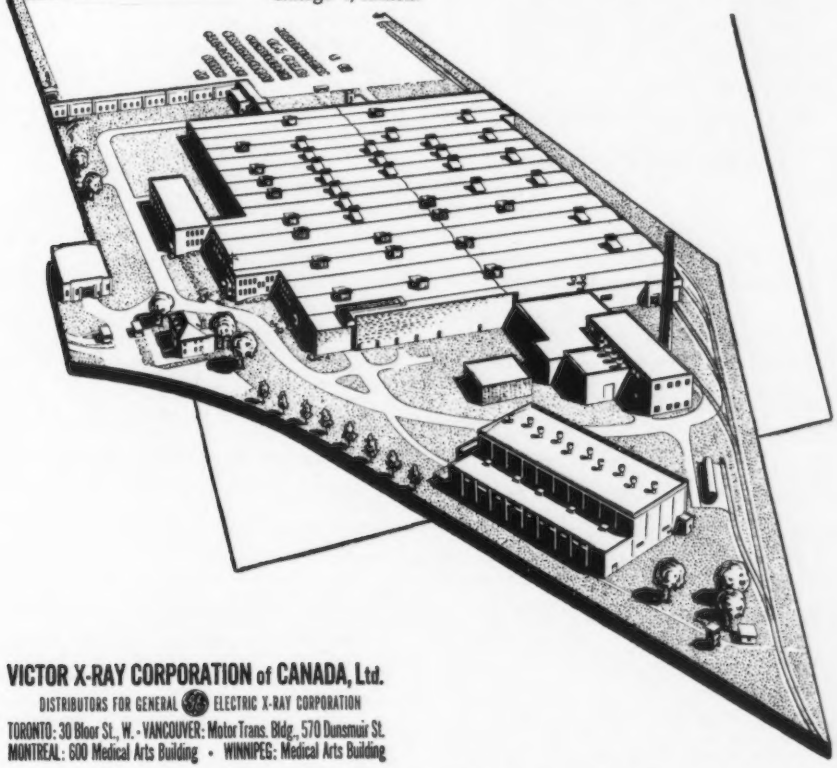

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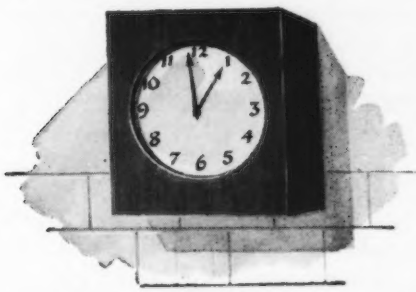

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Sussman, M. L., "In about 30% . . cystic duct, with or without the common, is visualized in anywhere from 5 to 30 minutes later . . . the demonstration of a normal cystic and common duct is a valuable confirmation of a normal function of the gall bladder and the sphincter of Oddi." *Sussman, M.L., Emptying of the Normal Gall Bladder, Amer. Jr. Roent. 38: P 867, Dec. '37*

Kirklin, B. R., "The interim fatty meal is highly useful . . . to exhibit to better advantage papillomas or stones . . . more readily visible in a small amount of opaque medium . . . to distinguish by the fact that it does alter in size, a true cholecystographic shadow from a primary shadow by a diseased gall bladder." *Kirklin, B. R., Accurate Technique in Cholecystography. Amer Jr. Roent. 25: P 595, May '31*

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The Technician and X-Ray Therapy

By C. J. BODLE, R.T.
Winnipeg, Man.

THERE seems to be a wide difference of opinion on the part of radiologists and technicians as to what the technician should know about x-ray therapy. Such expressions as, "the technician does not need to know anything about it, only to do as he is told," also, "there is nothing to therapy technique, it can be learned in a few minutes," have been heard by the present writer. With both these opinions he respectfully begs to differ.

It has been suggested that questions on therapy be omitted from the examination papers and that a special examination and distinctive registration be established for therapy technicians. I do not believe this is necessary or advisable.

Many technicians, it is true, have no contact with therapy, while others have a considerable amount of this work to do, but I believe that any qualified technician worthy of the name, should at least be familiar with the theoretical aspect of the subject. Practical experience can, of course, only be gained by actually doing the work.

A vast amount of information on the technique of x-ray therapy has been published in various books and in the radiological journals, but in the experience of the writer, many technicians have a very superficial acquaintance with the subject, and often. somewhat confused and hazy ideas. Technicians should have an enquiring mind and keep on asking *Why?* We are all prone to take everything we read as fact and to accept many simplified general statements at their face value, without asking ourselves (or anyone else for that matter) what they really mean. It is only by enquiring fully into the reasons for many of the procedures used in our daily work that x-ray technical work may be lifted from dull routine to something that leaves a feeling that perhaps, after all, it is worthwhile.

One of the difficulties in writing on therapy for technicians was to decide what to include and what to leave out. It goes without saying that no technician should, under any circumstances, undertake any therapeutic procedure without direct supervision and specific instructions from a radiologist.

Dosage, or the clinical aspect, is strictly the province of the radiologist and does not concern the technician, but the application of the radiation *as prescribed by the radiologist* and the correct recording of the same, is the duty of the technician, and if this is to be done correctly and intelligently, then it is imperative that the technician should have a sound working knowledge of the physical principles involved and, in addition, a good elementary knowledge of Anatomy. Without such a background he or she is not a technician but a mere "button pusher."

Physical Factors in X-Ray Therapy:

The technician should have a good grounding in general physics in order that he may have a clear understanding of how the measurements are made of both the quantity and quality of the radiation from the apparatus, under any given set of conditions, and how to compute the intensity delivered to the skin of the patient and at any depth in the tissues.

In large institutions such measurements will be made and the apparatus standardized by a physicist, but in many radiological departments portable measuring instruments (roentgen or "r" meters) are available for making routine measurements of the output from the machine.

There is no inherent difficulty in using such instruments. They are designed and intended for practical use in the radiological department, and are calibrated against a standard chamber to read "roentgens" under normal working conditions and should be checked from time to time by a competent physicist. Provided certain necessary precautions are taken in placing the chamber in the correct position and avoiding scattered radiation, there is certainly no reason why such measurements cannot be made by a *competent, trained* technician. It does not require the skill or training of a physicist or engineer to use such instruments correctly.

On looking over the questions on the therapy papers set for the examination for membership in the C.S.R.T., it would seem that these cover a good part of what may be considered essential knowledge for the technician.

The following four questions have been selected as a basis for this paper:

(1) Define the international unit of x-radiation. How is it measured?
(2) What is meant by the half value layer?
(3) Why are filters used in x-ray therapy and what is the effect of the filter on the quality or mean wave length of the x-ray beam?
(4) What is meant by "percentage depth dose" and what are the various factors influencing the depth dose?

Given a sound working knowledge of the physical principles involved in the above questions, the technician should have the necessary background to carry out technical procedures in therapy intelligently.

Measurement of Quantity:

Before the introduction of ionization methods of measuring the output from the apparatus, several methods were tried; chemical, photographic, and calculation of intensity from formulae. None of these methods proved to be accurate but were a useful guide in their day. The only acceptable and accurate method to-day is the use of ionization instruments.

The quantity or intensity of the radiation beam must be measured directly from the beam itself. Before we can understand how this may be accomplished, it is necessary to review very briefly some points of the modern atomic theory and the phenomenon of ionization.

The modern atomic theory states that all matter is composed of atoms, consisting of a heavy nucleus which contains protons (or positively charged

particles), and electrons (negatively charged particles) travelling in eliptical orbits around the nucleus at a high rate of speed, in much the same way as the planets of our solar system travel around the sun. The nucleus being positively charged tends to attract the negative electrons, this attraction being balanced by the centrifugal force of the speeding electrons, thus holding each electron in its orbit or energy level. The normal atom is electrically neutral as the negative charge of the orbital electrons is exactly balanced (or neutralized) by the positive charge on the nucleus.

When an atom loses one or more of its orbital electrons it is said to be *ionized.*

Ionization:

When x-rays pass through gases or liquids, some of the atoms are ionized. When an atom loses one of its orbital electrons, the nucleus has one unit of positive charge in excess of the amount necessary to neutralize the negative charge on the remaining electrons and there is left what is called a positive atom ion, or more simply a *positive ion.* The electron which has been removed from the atom (by bombardment by a "photon" of radiation) may remain free but more frequently will become attached to a neutral atom or molecule, forming a *negative ion,* or it may recombine with another positive ion to form a neutral atom. It is this power, possessed by fast moving electrons and x-rays, of ionizing a gas, which is the basis of the method of measurement of the physical unit of x-radiation, the roentgen or "r".

When air or gas is ionized it becomes a conductor of electricity, the conductivity being in direct proportion to the degree of ionization, which in turn, is directly proportional to the intensity of the x-ray beam. By measuring the flow of electric current across an air gap which is exposed to the ionizing effect of x-rays, the intensity of the beam may be measured.

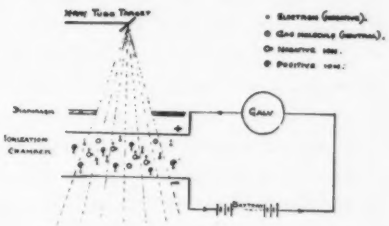


Fig. 1. Mechanism of Ionization.

Ionization Chambers:

The standard ionization chamber used by physicists to determine the roentgen is described in any text-book on the physics of radiology. [1, 2]

For practical use in the radiological department, portable measuring instruments, with a so-called "thimble chamber" have been developed; the best known and most widely used on this continent * having a small detachable chamber which may be used for making measurements in "free air," or directly on the skin of the patient and for phantom measurements.

The international unit of x-radiation, the roentgen or "r", is defined as follows:

"The roentgen or 'r' is that quantity of x-radiation, which, when the secondary electrons are fully utilized and the wall effects of the chamber avoided, produces in 1 cubic centimeter of air

*"Victoreen" Condenser "r" meter.

at 0° cent., and 760 m.m. pressure, such a degree of conductivity that one electrostatic unit of charge is measured at saturation current."

This definition was revised in 1937 in more specific terms, for the purpose of applying the method to radiation produced by "super voltage" apparatus and gamma rays, but for all practical purposes, for rays produced at voltages up to about 300 k.v.p. the two definitions are essentially the same.

I do not believe it necessary for technicians to memorize these definitions any more than it is necessary to memorize the definition of other standard units such as the inch or the metre, or any other well established measuring unit in everyday use. They can be looked up in a text book.

What is necessary, is that we should remember that the roentgen is a physical unit, a measure of quantity only and does not give any information about the beam of x-rays other than its intensity.

Measurement of Quality:

In order to define a beam of x-rays completely, it is necessary to state the quality or penetrating power of the beam in addition to its intensity.

As no beam of x-rays is homogeneous, i.e., composed of rays of a single wave length, it is not possible to state its *quality* precisely by a single numerical factor.

A beam of x-rays may be analyzed into its component wave lengths in a similar way to that in which visible light may be analyzed and the intensities of the different wave lengths measured. Such an analysis is called a spectrum.

Different types of generators, with their resulting different wave forms, will produce beams with different spectral distributions of their component wave lengths. Even constant potential apparatus does not produce homogeneous radiation.

For a given peak voltage, with any type of apparatus, there is a very critical minimum wave length which sharply defines the beam. This minimum of shortest wave length depends solely on the maximum or peak voltage and may be determined by the following simple relation. [3]

$$\text{Shortest wave-length (in Angstroms)} = \frac{12354}{\text{Voltage max.}} \text{ or, } \lambda \text{ min.} = \frac{12354}{\text{k.v.p.}}$$

Although the minimum wave length is the most penetrating part of the beam, it is not the most intense.

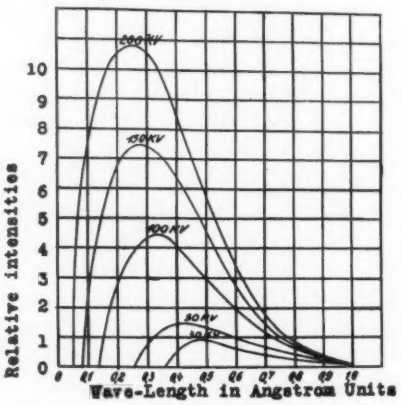


Fig. 2. Relation of Intensity and Wave Length (Ulrey).

Fig. 2 shows a set of curves for radiation intensities produced at various voltages. It will be readily seen that as the voltage is increased the minimum wave length becomes shorter and that

there is a shift in the maximum intensity toward the shorter wave lengths. A casual study of such graphs will show clearly why it is not possible to give a single numerical value for the quality or penetrating power of such mixed beams. What is required in therapy is some practical descriptive index which will give the mean or average penetration of the radiation under any given set of conditions of voltage and filters, and permit the reproduction of one of the essential treatment factors, the penetration or "depth dose."

The most practical method of expressing the quality of a beam of x-rays for therapy and which is now generally accepted is to state the half value layer.

The Half Value Layer:

The half value layer (h.v.l.) is that thickness of some absorbing material, such as copper or aluminum, which will reduce the intensity of the beam of x-rays to one half its initial value. The simplest and most generally satisfactory method of obtaining the h.v.l is by means of an absorption curve, plotted from measurements on the apparatus in use. [4]

For voltages up to about 125 k.v.p. aluminum is a suitable material; for higher voltages copper is the material of choice.

H.v.l. measurements are not usually made of the unfiltered beam (except for superficial therapy) but with the prescribed filter for a given set of treatment conditions in place. The first reading is made from the actual beam used for treatment and further filters added in steps of equal thickness. The intensity through each succeeding thickness is recorded and a curve plotted from these measurements. It is a simple matter then to read off the h.v.l. from the curve.

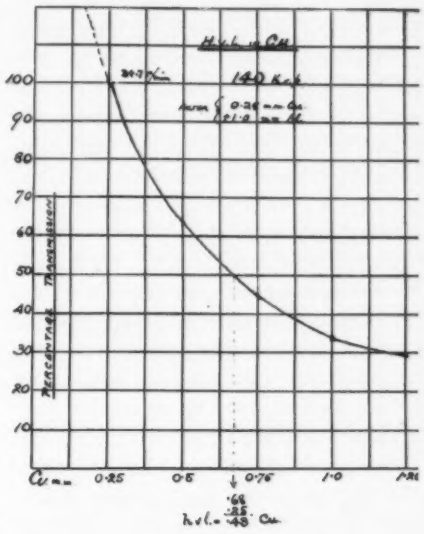


Figure 3.

Fig. 3 shows such a curve for a beam of x-rays produced at 140 k.v.p. filtered through 0.25 m.m. Cu. and 1 m.m. Al. Taking the intensity of the beam with the initial filter of 0.25 m.m. Cu. as 100% it will be seen that the intensity is reduced to 50% by a total thickness of .68 m.m. Cu., then by subtracting the thickness of the initial filter from this figure, .68 — .25, the h.v.l. .43 m.m. Cu. is obtained.

H.v.l. in Aluminum:

A simple method of measuring the H.v.l. in Al. is described by Dr. W. H. Meyer. [5]

The method is photographic and certain objections have been put forward against it, but if carried out carefully

a very fair degree of accuracy may be obtained. All that is required is a step ladder of Al. in one m.m. steps. The Al. step wedge is placed on a single coated process film in a light tight envelope and a thick strip of lead of the same length as the wedge is laid beside it. A short exposure is then made. The lead is then removed and a second exposure of exactly the same intensity is made and the film processed and dried. The part of the film covered by the lead during the first exposure will thus have received exactly one half the intensity of that under the Al. ladder. By matching the density of that portion of the film under the Al. which corresponds with the density of the strip under the lead, the h.v.l. in Al. may be determined.

Filters:

The use of filters in x-ray therapy is primarily to protect the skin and superficial tissues and to permit a greater percentage of the radiation to be delivered at a required depth below the surface. When a metal filter is inserted in the path of the x-ray beam, two things happen. First, the intensity of the beam is reduced; second, the composition of the beam is changed. The filtered beam will contain a larger proportion of the shorter wave lengths, which is the effect desired in deep therapy. The higher the voltage and thicker the filter, the shorter the mean or effective wave length of the emergent beam.

Fig. 4 shows diagramatically the effect of the filter on a beam of x-rays.

The most suitable materials for filters in x-ray therapy have been found to be aluminum, copper and tin, or some combination of these metals. [6, 7, 8]

For voltages up to about 130 k.v.p. aluminum is a suitable filter; for higher voltages, copper or some combination of materials of higher atomic number are usually employed.

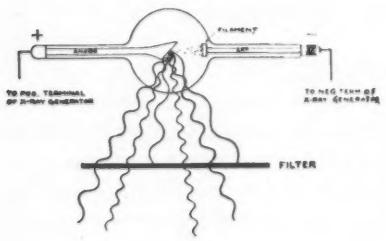
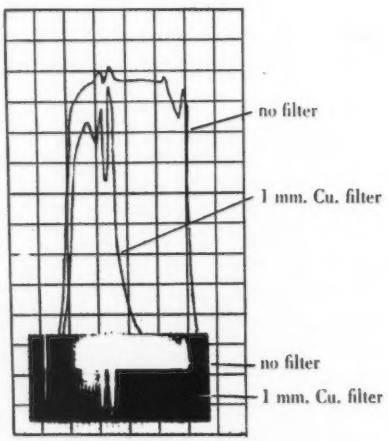


Figure 4.

X-RAY SPECTRA



TRANSFORMER. Fluctuating Voltage
200 KV. (Peak) Tungsten Target

Figure 5.

Fig. 5 shows two spectra (taken from Dr. Otto Glasser [9] for a beam of x-rays from a mechanically rectified machine at 200 k.v.p. The upper spectrum shows the whole range of the unfiltered beam; the lower one shows that practically all the radiation of longer wave length than the characteristic K lines of tungsten (produced at about 90 k.v. and shown in the spectrum as the two very

intense lines superimposed on the spectrum of the general radiation) has been filtered out by 1 m.m. of Cu.

The intensity curves above the spectra show that in addition to reducing the intensity of the beam as a whole, the filter also absorbs a considerable quantity of the desired short wave lengths as well. It is obvious, therefore, that there is a limit to the thickness of filter which may be used economically, if the time needed to deliver a given quantity of radiation is not to be unduly prolonged. It is customary to use an auxiliary filter of 1 m.m. Al. below the Cu. filter to absorb the very soft characteristic radiation from the copper.

Surface and Depth Intensities:

The total radiation effect on the skin will include the "back scatter" from the tissues at depth. This will vary with the size of the surface field and the thickness of the part; in other words, with the volume of tissue irradiated, also with the quality of the beam, and for large fields may reach a high figure. This problem of back scatter has been investigated by many physicists and accurate tables have been published for depth intensities with various qualities of radiation and sizes of skin fields and a range of focus skin distances. Tables are available giving percentage depth intensities in "r" per 100 roentgens on the skin, also for surface and depth intensities per 100 roentgens in air. [10]

Accuracy in centering the beam in therapy is imperative, more especially where multiple fields are used, as in crossfiring for the purpose of delivering a larger dose to a lesion situated at some distance below the surface which could not be adequately treated through a single skin portal. If the beam is not precisely centred on each field at the correct angle necessary for the beams to meet at the required depth in the tissues, uneven distribution will occur, perhaps resulting in a large portion of the radiation being delivered outside of the desired area. Cones and applicators of proper dimensions are of great assistance in directing the beam correctly and in limiting the field. A few experiments with films in a phantom will prove illuminating and instructive.

In view of the foregoing then we may outline the duties and responsibility of the technician in x-ray therapy. First, he must see that the apparatus is functioning correctly and that all the physical factors for a prescribed treatment are accurately checked.

The importance of the correct filter being in place cannot be overemphasized. The accidental omission of a copper filter during treatment might result in a dose many times greater than that required and might cause serious damage to the patient and to the reputation of the radiologist.

The focal skin distance is a much more important factor in therapy than in radiography. When working at a short focal skin distance, as is often the case when treating surface lesions, an error of one or two cms. may make a tremendous difference in the dose delivered to the skin. Voltage and milliamperage must be accurately measured to ensure the correct output and reproduction of the same. While a minor error in any one of these factors may only effect a small percentage change in the total dose delivered, a compara-

tively small error in all of them operating at the same time (which could easily occur under routine working conditions) may cause the total percentage error in dosage to assume a fairly high figure.

The following table published by Dr. Edith Quimby [11] shows the possible magnitude of such errors which are probably tolerated in practice.

From Otto Glasser, Ph.D. Radiology, Vol. 3, No. 3, page 202, Sept., 1924.

ERRORS IN DOSAGE DUE TO INACCURACIES IN PHYSICAL FACTORS

TABLE 1

Physical Factor	Best Range Possible	Error in Factor (per cent)	Error in Dose (per cent)	Range Probably Tolerated	Error in Factor (per cent)	Error in Dose (per cent)
Kilovolts	2 kv in 200 kv	1	2	5 kv in 200 kv	2.5	5
Milliamperes	1 ma in 30 ma	3	3	1 ma in 10 ma	10	10
Time	15 sec in 10 min	2.5	2.5	30 sec in 10 min	5	5
Distance	1 cm in 50 cm	2	4	2 cm in 50 cm	4	8
Total error if all variations acted in same direction		11.5			28	

Dr. E. H. Quimby. "Physical Foundations of Radiology." Page 244. Paul B. Hoeber Inc., N.Y., 1944.

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field does not fully specify the dose delivered to that area.

In the case of cross-fire radiation, it is necessary to state the "exit dose," i.e., the amount of radiation received by the skin on the opposite side to that treated, as this quantity must be added to the radiation delivered directly to such area when computing the skin dose.

Therapy Records:

The correct recording of the treatment given to the patient is also the duty of the technician. This is perhaps one of the most neglected and inadequately performed operations in radiation therapy. Dr. Quimby [12] discusses this matter fully and points out the inadequacy of many reports which fail to specify tissue doses when treating deep seated lesions, but which merely state the skin dose, or roentgens "in air" without mention of the quality of the beam. As the dose delivered to any area of the skin will include the back scatter and this will vary with the size of field and quality of the beam, it is obvious that the statement 1000 "r" in air to a given skin

The data to be recorded then in addition to the calibrated physical factors are — (a) the region treated, (b) size of the field, (c) Focus skin distance, (d) time, (e) "r" in air, (f) "r" on skin (per day), (g) interval between treatments, (h) total "r" per field, and, if the depth and size of the tumor or disease area is specified, the quantity (or dose) delivered to that area.

It will be seen then that the technician's responsibility in therapy is not to be taken lightly. By a thorough study of the method of work and the intelligent application of well understood principles, the technician becomes a valuable and valued assistant to the radiologist responsible for the welfare of the patient.

In preparing this paper the writer has drawn freely from the literature and makes no claim to any originality or superior degree of knowledge of the subject, the sole intention being to draw the attention of technicians generally to the importance of a working knowledge of the physical principles on which modern x-ray therapy is based. This may be readily acquired by a study of the two text books mentioned in the references (1 and 2), both of which books should be in the library of every x-ray technician. If the perusal of this paper stimulates any other technician to improve his knowledge of the technique of x-ray therapy, the writer will feel well repaid for his efforts in compiling it.

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Encephalography

By ALBERT R. CHEFFINS, R.T.

Neurological Institute, Montreal

SINCE the discovery of the Roentgen Ray by Wilhelm Conrad Roentgen in 1895 there has been a continual advance in its uses by the Medical Profession. In its very earliest stages it was used only for the visualization of the bony structures of the human body, but with advancing improvement in equipment, and as the processing of the films, glass plates as they were in those early days, approached nearer to perfection, the use of the Roentgen Ray became a necessary means of diagnosing the various ailments that beset mankind. However, due to tissue similarity there was much in the body make-up that could not be definitely indicated; hence the use of contrast media came into the field of Radiology.

To-day all technicians are familiar with the various means of visualizing the different parts of the anatomy. The Tuberculosis Specialist has his Bronchogram or visualization of the Bronchial Tree after intratrachial injection of an opaque medium such as Lipiodol. The Urologist is able to diagnose the diseases of the kidneys and urinary tract by means of the intravenous pyelogram; the injection into the veins of Diodrast, Iopax or other opaque substance that is absorbed by the system. There is the Venogram for the visualization of the veins; the Cholecystogram, oral or intravenous, for disorders of the gall bladder.

Spinal deformities and disc injuries are to-day located by means of the Myelogram, a fluoroscopic and radiographic examination of the spine, after an opaque substance has been introduced into the spinal canal by means of an ordinary lumbar puncture. These aids to medicine did not come about suddenly, but only after years of study, research and experimentation by the greatest in the field of medicine and radiology.

So far, then, by way of introduction I have briefly touched upon the general all-purpose contrast media such as may be said to be in common use in the smaller hospitals of our country towns. But there are also gases which have their place in this field of diagnostic radiography. Air, Oxygen Carbon Dioxide, Nitrogen and Helium have all at some time served a purpose. Air and Oxygen, however, are most commonly used. All of you are probably familiar with the use of air in Pneumocystography; filling of the urinary bladder with air when tumor of the bladder is suspected, and with Pneumoperitoneum, the introduction of air into the abdominal cavity for the purpose of indicating the relationship one to another of the abdominal organs. So, in the progress of time came the use of air or gas as a contrast media in the roentgenographic examination of the ventricles of the brain.

* Read before the Province of Quebec Society of X-Ray Technicians at the Annual Meeting, Montreal, May 18th, 1946.

History:

Air as a contrasting medium in the ventricles of the brain was discovered in the year 1913 when the case of a fractured skull came under the consideration of Dr. W. H. Luckett. Distinct markings of this foreign substance were clearly visible in both the antero-posterior and lateral views of the skull and was identified as air. Spontaneous filling of the ventricles with air under similar fracture conditions were reported in 1916, 1917, 1918 and 1919. However, it was in the year 1918 that the first experiments in the use of air as a contrast medium for the diagnosis of brain disorders were made by the late Dr. W. E. Dandy, who at first introduced air into the ventricles through a trephine opening made in the skull. In 1919 the method of introducing air into the spinal canal as a means of outlining the cerebral structures on x-ray plates was first used. It was in 1921 that the term "Encephalography" was coined. Drs. Davidoff and Dyke in their thesis "The Normal Encephalogram" define "Encephalography" as the "demonstration of cerebral structures on the roentgenogram after replacement of cerebro-spinal fluid with air or some other gas introduced through the lumbar or cisternal route."

Ventricles:

At this point it would be appropriate to consider for a moment the ventricles and their location within the cranial sphere. Ordinarily a "ventricle" is a reservoir or container. Hence the ventricles of the brain are reservoirs or cavities in the brain containing the cerbrospinal fluid and are connected by means of small passages or corridors to the spinal column. The ventricular system is made up of four cavities, two on either side of the head, known as the "laterals" and two others designated the "third" and "fourth." The third ventricle is located centrally between the two "laterals" and communicating with them above and in front by way of a narrow canal named the Foramen Monro, and with the fourth ventricle which is below and behind by a passage known as the Aqueduct of Sylvius. The fourth ventricle lies also centrally and lower than the two lateral ventricles.

Purpose:

The air or gas injected into the spinal canal, being lighter than the fluid, rises, extending upward beneath the subarachnoid space around the brain and eventually into the ventricles; and by this means practically every disease within the intra-cranial cavity may be diagnosed. The procedure is especially useful in the diagnosis of Hydrocephalus, Brain Tumour, Epilepsy and Cerebral Hemorrhage.

Methods of Injection:

The apparatus for injection and the method of employment has varied considerably since the early days of Encephalography. One early system was an arrangement by which water poured into an elevated funnel and allowed to run down through a rubber tube into a glass flask, entering at the bottom. At the top of the flask was a rubber stopper through which was passed a glass tube connected by rubber tubing to the spinal needle. As the water spilled into the flask the air so displaced was forced into the spinal canal,

replacing a certain quantity of fluid which had previously been allowed to escape. Another early method was to have two needles inserted, each connected by rubber tubing and glass feeders to a small glass jar. As the fluid dripped from the lower needle into the jar it simultaneously forced air into the spinal canal through the upper needle. Later another automatic simultaneous replacement device was designed. With the patient in a sitting position, two punctures were made, the lower needle connected by means of rubber tubing to a special jar into which the spinal fluid flowed, displacing the air as the jar filled. This air then passed into a second and smaller jar, where it was passed through a solution of sterile water and then into the subarachnoid space through the upper needle. More recently, oxygen has been most generally used and the method of injection is quite simple. The oxygen is allowed to escape from a cylinder into a rubber bladder which acts as a reservoir. This is connected by a rubber tube and three-way stop cock to the lumbar puncture needle. Sometimes a syringe is filled from the rubber bladder and applied directly to the needle, the gas being forced by thumb pressure into the spinal canal. The amount of gas injected is variable, some operators preferring to use as little as possible while others believe that the process of replacing fluid with gas should be carried on till the ventricles can take as large a quantity as possible. Anywhere from 10 cc. to 200 cc. may be used, though quite satisfactory encephalograms are usually obtained with only 100 cc. or 120 cc. of gas, replacing similar quantities of fluid.

Preparation of Patient:

Before undergoing this examination it is necessary that the patient be properly prepared. The tests are usually made in the mornings, therefore, the evening before, three grains of sodium amytal are given, in order that the patient may be restful during the night. The dose is repeated in the morning, and a little later morphine is hypodermically administered. The patient is allowed no breakfast and should be ready for the procedure at an early hour, usually around 9.00 or 9.30 a.m. The lumbar puncture and injection of gas is generally carried out in a special dressing room, but in some cases the whole procedure is done in the radiological department.

Reaction:

The preparation of the patient and injection of the contrast medium into the ventricles is, of course, no concern of the radiological technician. His worries begin when the patient is transferred from his bed or operating table to the x-ray couch. His work is easy or difficult according to the reactionary effects of the gas upon the patient. Those undergoing the test are differently affected. The symptoms of air within the ventricles are severe headache, pallor, sweating, slow pulse, nausea and vomiting. A patient may be quite conscious and co-operative, able to do everything required of him. Another patient may be quite helpless and have to be forcibly controlled throughout the whole procedure — and if at all cognisant of his predicament may resist and perhaps vomit frequently, thus possibly making several "retakes" necessary, especially as all views are in stereo.

Radiological Equipment and Positioning:

Methods of x-raying vary according to the equipment available and the special desires or practices of the Neurologist. Some claim that for encephalography, it is advantageous to make all examinations in the upright positions and special equipment is provided for this purpose. Such a method is described in Sante's "Mauual of Roentgenological Technique." Also described there is a specially constructed head-unit with x-ray tube constantly centred to a head Potter-Bucky Diaphragm, mounted on a bar which can revolve through 360 degrees. With this equipment the tube may be placed below the patient's head and the cassette above. This unit is particularly useful to those who prefer the horizontal method of examination and who prefer to have the ventricle filled with air near the film surface, it being remembered that air always rises, therefore the ventricle uppermost in the lateral position will contain the greater amount of air. Ordinarily the positioning of the patient may be described briefly as follows:

With patient supine:
- Fronto-Occipital—Stereo.
- Horizontal Laterals (brow up)—Stereo.

With patient prone:
- Occipito-Frontal—Stereo.
- Horizontal Laterals (brow down)—Stereo.
- Right and left laterals, in routine positions—Stereo.

Generally before taking the routine lateral projections it is necessary to direct the free air from one ventricle into the other by rotating the patient's head back and forth. After taking first pair of lateral views, the patient is quickly turned, care being taken not to allow the head to drop below the level of the shoulders, and the procedure is repeated in order to transfer the air to the other side. Then the opposite projections are made.

Procedure in Radiological Department:

At the risk of being accused of repetition, may I be permitted to describe two methods of procedure both accepted as routine in their respective institutions, though, of course, departure from routine does occur occasionally. While visiting in New York in the Spring of 1943, I was privileged to witness an encephalographic examination being made at the Neurological Institute there. The whole procedure was carried out in the radiological department. The patient was seated astride a specially designed bench, his arms folded at chest level upon an adjustable back, or rather front, rest. The head was inclined forward and with the forehead resting against a vertical Bucky Diaphragm. The usual sterile precautions were taken and after painting the patient's back with iodine, a local anaesthesia was induced in the region of the lumbar vertebrae between which the puncture was to be made. The lumbar puncture needle was then inserted, and after a few drops of the spinal fluid had been allowed to escape, oxygen was injected by means of a syringe, the oxygen being drawn from a bladder, just previously filled from a standard gas cylinder. A sufficient number of cc's being injected, in the opinion of the attending Neurologist, the patient's head was positioned to the vertical Bucky for the postero-anterior

views, the central ray being projected horizontally. While still in the upright position right and left lateral views were made; all projections being stereo. These first films also served their purpose as scout films and upon the filling being considered satisfactory, the patient moved to the x-ray couch, where he was placed in the supine position for routine antero-posterior views, then turned to the prone position and obliquely inclined for standard right and left laterals. In this case there was no rotating or shaking of the head during the procedure. The patient was sent back to the ward in his bed and was conscious of the proceedings throughout. At the Montreal Neurological Institute our patients are prepared in a special dressing room and the spinal injection is made by means of the syringe and oxygen bladder method. The patient comes to the radiological department on his bed with the head and shoulders well elevated. He is transferred to the x-ray couch in the supine position with the head inclined upon a special head Bucky raised to an angle of 23 degrees. The first projection is made with the central ray directed perpendicularly downward. For the second projection the tube stand is displaced beyond the end of the table and tube tilted caudally 15 degrees. The head Bucky is now lowered flat to table top and a two inch wooden block is placed under the patient's head, the patient still in the supine position. The tube arm is swung around and the tube tilted to the horizontal in order to make lateral projections, i.e., stereo views with the brow up. A Lysholm Grid is used when making these views. These first four films are then developed for the purpose of noting the filling or any abnormality that may be indicated. In the antero-posterior projection the anterior horns of the ventricles should be seen as quite dark shadows and the temporal or inferior horns should be visualized but not quite so heavily shaded. The outlined ventricles appearing butterfly shaped. The two lateral views should demonstrate the lateral ventricles and the occipital horn, while the third and fourth ventricles may be slightly visible. Due to the upward inclination of the brow the anterior horns will naturally appear much darker, owing to the oxygen rising and more abundantly filling the uppermost cavities. The neurologist having expressed his satisfaction, the procedure continues. The patient is turned rapidly from the supine to the prone position and this time with the forehead resting on the two-inch wooden block, stereo lateral views are made with the brow down. The appearance of these two films should be similar to those just previously made, only the darker portion will demonstrate the occipital region of the ventricles. The block is now removed from beneath the patient's forehead and the head positioned routinely for the postero-anterior views, or the occipital-frontal, as sometimes termed. The first projection is made with the tube straight, and for the second the tube is displaced towards the patient's feet and tilted towards the occipital region so as to project the central ray 15 degrees from its perpendicular position. Frequently when the fourth ventricle may be especially involved, a third projection is made with a further backward shift

and an angulation of 20 degrees or more. The final projections are the right and left laterals. The patient is turned on to his side and the Neurologist rotates or shakes the head in order to induce a flow of air into the uppermost ventricle. With the patient then positioned in the regular manner, stereo projections are made. This procedure is repeated for the opposite side and the second pair of lateral views are made. In these lateral views the lateral ventricles should be demonstrated, with the third and fourth ventricles partially, if not wholly, visible. Of course, abnormalities may be present which prevent the contrast media entering these ventricles and if such be the case, then naturally the ventricles will not be visualized. The technician doing this type of work must be thoroughly familiar with regular skull technique, must know the correct shifts in order to properly project the views required, must remember that a right lateral projects the left ventricle and a left lateral the right ventricle, and may occasionally have to remind an interne of this fact. Also he must consider a possible shift of the ventricles to the right or left of the midline of the cranial sphere and such circum stances can only be accurately determined by the Radiologist provided that the antero-posterior views are made with the patient's head strictly in alignment and with no rotation. With reference to technique factors — in a paper of this nature it is practically impossible to quote any hard and fast figures. The technician must be guided by his own experience and the capacity of the apparatus at his disposal. As fast a time as possible should be used and definite high kilovoltage will ensure films of regular density in 99% of the cases. Tube angulation, too, must be in accordance with the radiographic department practice, since this will vary, depending upon whether the whole procedure has to be carried out on the ordinary horizontal table top. Our technique factors for skull work at the Montreal Neurological Institute are: M.A. 100. Time 4/10 sec. K.V.P. 68 for laterals and distance 36". Those fortunate enough to have 500 M.A. monitors and impulse timers should be able to work down to 1/10 sec. The series of 12 (or 13) views is usually made on 8" x 10" films.

COMING EVENTS

TENTH ANNUAL CONVENTION CANADIAN SOCIETY OF LABORATORY TECHNOLOGISTS, HAMILTON, ONT., MAY 29th-31st.

NINETEENTH ANNUAL CONVENTION AMERICAN SOCIETY OF X-RAY TECHNICIANS, BUFFALO, N.Y., JUNE 1st-6th.

FIFTH ANNUAL CONVENTION CANADIAN SOCIETY OF RADIOLOGICAL TECHNICIANS, SASKATOON, SASK., SEPTEMBER 4th, 5th, 6th.

X-Ray Studies of the Bronchial Tree by Iodized Oils

By G. G. HARRIS, R.T.
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WHILE studies of the bronchial tree through the medium of iodized oils may be classified as something special or apart from daily routine of the x-ray department the examination should not be considered beyond the capacity of the average hospital equipped with an x-ray unit.

As a diagnostic measure opaque medium was first successfully used to outline the bronchial tree in the latter part of 1921 when an internist named Leroux of the Hospital Neckar, Paris, produced very satisfactory bronchograms by the medium of Lipiodol. Today this method is used extensively to assist in diagnosing such conditions as carcinoma of the lung and other lung tumors, bronchiectasis, lung abscess, atelectasis, as well as localizing foreign bodies lodged within the respiratory system.

Radiography of the chest requires a low K.V.P. technique and the nature of this examination is so much in keeping with standard routine chest requirements that the portable 15 milliampere unit is capable of producing bronchograms of as good diagnostic quality as the larger 500 milliampere rotating anode machine.

The technician should be familiar with the method of investigation and have all preparations made ready beforehand in order that the examination may be carried out smoothly and effectively and good diagnostic bronchograms may be obtained.

Loaded cassettes should be close at hand and someone standing by to change the cassette for the lateral exposure if a stereo cassette changer is not a part of the x-ray equipment. Two chairs, one for the patient and one for the physician, when the investigation of lower portions of the lungs is to be carried out. Usually, one side only is investigated at each examination, with radiographs taken in the a.p. and lateral positions, however, both sides may be explored during the examination, first one side and then the other, with exposures made in the right and left oblique positions. The oblique exposures serve to distinguish the respective bronchial trees one from the other and in many cases individual segments of the lobes can be identified; this has become of real importance in recent months because of the increasing use that is being made in thoracic surgery of resecting only the affected segment rather than the whole lobe.

Preparing the patient by anaesthetizing the throat and larynx with cocaine or pontocaine is taken care of by the doctor before he arrives at the x-ray department and usually takes from ten to fifteen minutes, depending on the

* Paper read at Annual Refresher Course of the Nova Scotia Society of Radiographers, May 17th, 1946.

sensitivity of the throat. This phase of the examination is very often the deciding factor as to whether good diagnostic films may be obtained; its purpose is to assist the patient to have complete control of any desire to cough while the oil is being introduced into the trachea. Coughing contracts the pulmonary tissues to such an extent that the diagnostic picture created by the oil is ruined, making a further examination impossible for several days or until such time as all the oil has disappeared.

It should also be remembered that the examination may be a new experience for the patient, his emotional make-up may be such that he is nervous and apprehensive, therefore everything possible should be done to put him at ease. He should be acquainted with what is to be done, the films to be taken and how they are to be taken, in fact nothing should be overlooked that will contribute to his feeling of well-being, in order that diagnostic films will be obtained.

There are several methods of introducing the opaque medium into the bronchial tract for diagnostic purposes. The Supraglottic is one where the oil is dropped into the laryngeal vestibule by means of a curved or bent cannula fitted to a 20 or 30 cc. syringe, with or without previous anaesthesia. Another is the Transglottic injection. It calls for a longer cannula which must be passed between the vocal cords with the aid of a laryngeal mirror and previous anaesthesia. Also the Subglottic technique where the needle is inserted through the skin and the crycothyroid membrane, directly into the trachea, and last the Intra-bronchial injection which is given by means of the bronchoscope.

At the Nova Scotia Sanatorium the Supraglottic method is generally employed and found to give very reliable information with a minimum of discomfort to the patient. The amount of oil to be used is governed by the area of portion of the lung to be investigated. Usually from 10 to 15 cc's is sufficient to explore any one lobe at an examination and from 20 to 30 cc's for the whole lung. Positioning the patient during the injection is important, otherwise the medium may flow into both sides, particularly so when the left lung is being examined. The left bronchus, as you well know, enters the lung at a more acute angle than the right, making it necessary to incline the patient to one side at about an angle of twenty degrees. Apart from this, further posturing is not required when the base of either lung is under observation, the oil will flow throughout the area of the lower lobes with the patient in a sitting position. For the middle lobe the patient should be assisted to bend well over to the side and as far forward as possible in order that the oil may flow out to the periphery, otherwise much of the media will find its way into the base or lower lobe.

When exploring the apices of the lungs a semi-reclining position on the Bucky table is necessary. With the head resting on the palm of the hand, supported by the elbow, the table is inclined towards the feet just enough to allow the oil to flow down the trachea and into the bronchus. The injection is carried out as quickly as possible and the table is then tilted towards the head at an extreme angle for a minute

or so to insure a complete filling, then brought back to approximately 25 degrees and exposures made in the lateral and antero-posterior positions. Care should be taken to have the arms raised above the head when the lateral exposure is made, and the foot-rest should be placed in position to support and keep the patient from sliding off the table.

Sodium Iodide and Diodrast are other types of opaque media frequently used to demonstrate the length and breadth of a pleural pocket resulting from empyema. They are much thinner than opaque oils and can be easily aspirated from the chest when the examination is completed. The medium is injected into the pleural space with the patient lying on the Bucky table in the lateral position. Two exposures are made, one with the head tilted downward to outline the uppermost end of the sinus or pocket and one with the table tilted in the opposite direction to show the lower end of the pleural space. Antero-posterior exposures are made by bringing the x-ray tube into position to shoot "across" the table, having someone to hold the cassette against the patient's chest. Two exposures are made to show the upper and lower borders of the empyema pocket. In this phase of the examination the distance factor is limited to approximately 36 inches unless a portable unit is being used; however 36 inches is all that is required as the desired information can be obtained on 10 x 12 films.

The exposure technique varies very little from that employed for routine chest films. An increase of from 2 to 4 K.V.P. will reveal a good outline of the pattern created by the opaque medium, with the exception of the left base. Here the thickness of the heart increases the density to the extent that at least 6 K.V.P. more than standard technique on the same person is required to outline the oil sufficiently to be of diagnostic value. When the examination is carried out with the aid of Bucky diaphragm technique one may be guided by the exposure factors generally used when doing a.p. and lateral films of the thoracic spine, and while this may be slightly more than is necessary it is better to err on this overexposure side rather than on underexposure. It should be remembered that lung parenchyma detail is not a part of the examination but the outline or pattern of the opaque medium revealed in good contrast is what is required to make a diagnosis.

This comprises the general procedure for x-ray studies of the bronchial tree by iodized oils as carried out at the Sanatorium, and while examinations of this kind may not be routine with some of you, I trust it will be of some value and assistance in helping you in your x-ray work.

The Electro Magnetic Spectrum

By L. A. LUDWIG, R.T.
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THE picture of the electro-magnetic spectrum as presented to us by the physicist, can be a never-failing source of new amazement and intellectual stimulation. As we think of the present uses and the future possibilities of the various mysterious rays, we can let our imagination rove far afield and still not go beyond the further application of proven present performance.

When it is remembered that ordinary sunlight is composed of many colours and shades of colours and that these colours differ one from another only because of variations in wavelength, it becomes easier to believe that there may be still other "colours" which our eye cannot conceive and such in fact, is the case. Imagine how startling the world would look if some of the now invisible wavelengths of electro magnetic energies were suddenly to become visible — that is, if the retina of the eye responded to these energies the way it now does to light. We would marvel as we beheld the multitude of radio waves streaming through the streets and of course we would be enchanted at "seeing in the dark" with infra-red. Perhaps we would find something new to admire in the faces of our fellow men as we looked deeply into the tissues below the surface. Beauty would then, indeed, be more than skin deep. The imagination seems scarcely to have boundaries when one thinks of these and other possibilities *if* the portion of the electro-magnetic spectrum now visible, were to be extended in both the longer and shorter wave (lower and higher frequency) directions.

As has been mentioned, the wave length is the deciding factor in the make-up of the various types of electro-magnetic vibrations. This "wave" has been described as "a wave-like disturbance which pervades all space" and again, it is likened to the series of ripples which is demonstrated by dropping a pebble into a pool of still water. The whole "wave action", however, appears to leave much to the imagination and indeed is now in some quarters, in question. A later theory describes electro-magnetic energy as being released in the form of little driblets or "bundles of energy" and the "bullet" form of energy release is also a complimentary descriptive term. These "bundles of energy" are called Quanta or Photons, the latter term being more common. Of course, photons are a non-corpuscular nature — that is, they are not composed of matter, but are purely a form of energy. However, the latest experiments by physicists, especially in connection with cosmic rays, has led to the hypothesis that energy and matter may be transmuted one to the other.

These waves, remarkable as it may seem, and although they vary much in "size" or length, all travel at the same

speed. This is a tremendous speed, compared to anything in our everyday life — even faster than the speed at which the street car draws away just before you reach the boarding area, after you have puffed up the street at top run for half a block. Indeed, physicists tell us that electro-magnetic energies speed along at 300,000 kilometers or approximately 186,300 miles per second. As this speed remains the same, while the wave length is variable, there must necessarily be differences in the number of waves which pass a given point per second; this is termed the wave frequency.

As everything must have a unit of measurement, whether it be the pound the grocer uses to weigh out sugar, or the mile over which the winning horse exerts itself at the racetrack, a unit of measurement known as the Angstrom Unit has been devised to assist in mapping the electromagnetic spectrum.

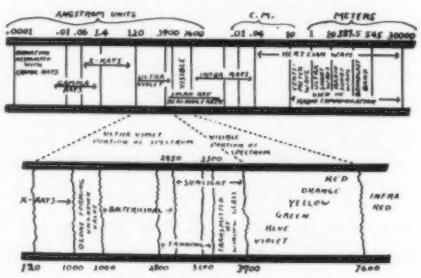
The angstrom unit is thus the "measuring stick"; measurements being based on a crest-to-crest distance of the wave. And now, how long is the measuring stick? Approximately one two-hundred-and-fifty-millionth of an inch. Hard to comprehend, isn't it? Compared to it, the 6 or 8 microns of a single human red blood cell is massive, as it would measure about 70,000 angstrom units. Let us put it down in terms of the larger units, working gradually smaller so we may readily follow. The centimeter, of which approximately 2½ make an inch, is divided by 10 to make the millimeter, which is divided by 1000 to make the micron, which is again divided by 1000 to make the millimicron and the millimicron is lastly divided by 10 to make the angstrom unit.

1 Centimeter = 10 Millimeters
1 Millimeter = 1000 Microns
1 Micron = 1000 Millimicrons
1 Millimicron = 10 Angstrom Units (A.U.)

Of late there is still another subdivision, the "X" Unit, of which there are 1000 to the angstrom unit.

Now, looking at the diagram of the electro-magnetic spectrum, we will note that the section marked "visible portion" is quite tiny compared to the portion other than visible. One comparison has it, that if the entire spectrum was a piano keyboard of sixty octaves, the visible portion would be only one octave.

ELECTROMAGNETIC SPECTRUM



N.B.—Lower portion of diagram is enlargement of visible band of spectrum in upper portion.

It is common knowledge that a prism under proper conditions, will break up visible light into its different colours. The rainbow provides excellent evidence of this in nature and can, at times, be quite a spectacular example. In the middle is the yellow which graduates to the shorter waves of violet by stages of green and blue, while on the longer wave end, it reaches red and dark red to a point where invisibility occurs — going first through orange-red and the tones and shades between these colours.

As we proceed to still longer wave lengths we must rely on evidence of their existence by methods other than direct vision for we have now reached the infra-red region, or as they are sometimes termed, the heat rays, which are, of course, invisible. Exploration in this region is sometimes made by throwing its spectrum through a prism on a prepared sheet of paper which has been soaked in alcohol, and noting degrees of evaporation of different linear areas. Photographic exploration to about 20,000 A.U. has been made, and commercial films are available which permit the ordinary use of infra-red to about 13,500 A.U. These rays possess certain powers of penetration which visible light does not have, of which property many spectacular uses have been made. Among these uses are the revealing of writings or printing which have been blotted out by a censor's brush, and the delineation of the superficial veins of the human body. Another important use in wartime is in the detection of enemy aircraft by the invisible infra-red radiated by the engines. A screen coated with zinc sulphide is brought to fluorescence by ultra violet to which the infra-red, when it strikes the screen adds the very remarkable effect of "flashing" or brightening of the fluorescence.

As we pass on to still longer wavelengths we come to the Hertzian waves composing the ultra-short, short and long radio waves which, although they now seem commonplace, affect our daily enjoyment of life to such a degree. Because of the globe-circling properties of radio waves, the peoples of the world are in much closer contact than would otherwise be possible. This should lead to a fuller understanding between nations which might quite easily alter world history of modern times.

It will be noted on the diagram of the electro-magnetic spectrum that the A.U. became a little unwieldy in handling after passing the visible portion. So to simplify our figures, we converted to the centimeter and meter scales. These are easier to fix in the mind than the mathematical formulae usually seen. A meter is approximately 39 inches. 1 Meter $= 1 \times 10^{10}$ A.U.

Having reached the longest wavelengths of our spectrum and remembering that beyond these exist the non-radiated electric waves used in speech and power transmission, we return now to the visible portion to explore in the other, the higher frequency, shorter wavelength direction.

Sunlight, besides containing all the colours, imparts to us the invisible radiation of ultra-violet which produces sunburn and tan. These radiations are in the order of 3200 to 2800 A.U. and this is known as the biologically effective band. Longer wavelengths than these, the 3800 to 3200 A.U. band, are useful in certain types of photography and fluorescent displays. The band 2800 to 2000 A.U. is known as the bacterial band which is lethal to most micro-organisms. The ultra-violet produced by the now popular cold quartz lamps is rated at 2537 A.U. and is used in the body cavities for medical purposes with a specially designed "orificial" applicator, in addition to the conventional external uses. Dropping still lower, we come to the 1000 to 2000 A.U. ozone producing band about which very little hitherto appears to be known.

The use of ultra-violet is becoming very widespread as the fluorescent lamp gains popularity. These lamps are generally in tubular form, the inside of the glass being coated with a fluorescent material, with the coating material being chosen for the desired colour of emitted light. Among the coating materials used are, Zinc Silicate, Cadmium Silicate and Calcium Tungstate. These powders are known as phosphors, which transform invisible ultra-violet radiation into visible light. Another interesting use of ultra-violet radiation is as the energy source in photo-electric apparatus designed for use in burglar alarm systems. The radiation being invisible, an intruder is unaware that by breaking a "beam" of ultra-violet, he has transmitted a signal and goes on with his work, perhaps to be caught red handed.

Going still further down our scale, our ultra-violet now begins to merge with the longer wave lengths of x-rays, which at this end are so soft that to date, no practical use for them has been found.

Of the uses in the Medical and Industrial fields, for the penetrating qualities of the Roentgen and Radium rays, no mention need be made in an article of this kind addressed to x-ray technicians. But perhaps worth mentioning is the old verbal formula "familiarity breeds contempt," and while for greater accuracy we may substitute the word "indifference" for "contempt," we who daily work with this ever-amazing and marvelous ray must never allow ourselves to get into a routine of indifference and disrespect for the tremendous potentialities of the Roentgen ray.

To complete our quick journey over the spectrum we come to the Cosmic Rays, the wave lengths of which are still shorter than the Gamma rays of radium and which range up to the highest frequency radiations known. These cosmic rays are of interest for their mysterious origin, but it is known that they originate outside the earth's atmosphere.

The rays have penetrating qualities to an amazing degree, putting to shame the shortest x-radiation man can produce. Scientists have measured the strongest radiations 10 miles high, using a rubber balloon to carry their instruments to that height. They have detected cosmic rays hundreds of feet deep in water, sinking the instruments to make the measurements.

Much work is now in progress to discover whether the cosmic ray is actually a ray, or a particle — that is, non-corpuscular or corpuscular. Some physicists believe the findings will indicate a percentage of both. We are told that as residents of this earth, we are subject to constant bombardment by this highly penetrating ray, by day and by night. The natural question which arises from this, is to wonder what the effect on our bodies is when even the comparatively long rays of radium and x-radiation kill living cells. The answer given is that the quantity of cosmic rays per square inch striking the body is so small, that any damage done is quickly repaired by the natural recuperative cell-building powers.

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Some Problems of the X-Ray Department

by SISTER MARY DAVID, R.N., R.T.
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THERE are problems to all X-Ray Departments, but because of the lack of uniformity in the organization and scope of the work, there is a little difficulty in assembling material for the discussion of my topic. Some hospitals make the X-Ray Department responsible only for radiographic examinations; others include x-ray therapy; others combine with the x-ray service, physiotherapy, pneumothorax, electro cardiology, urology, prenatal examinations; while some of the smaller hospitals may combine this department with some other service such as clinical laboratory.

In the first class of organization, strictly x-ray, the problems while always present, will not be so numerous, but under the more extensive plan they become quite involved and require efficient management.

The immediate Department Staff consists of:

The Radiological Director (or in the case of a small hospital the district Radiologist Consultant); the Technician Supervisor (the one Technician of a small department).

As we proceed to the larger hospitals the Graduate Technicians; the Student Technicians; the Aides; the Office Staff; probably student nurses; the department janitor or maid.

Order begins within the department, therefore clear definition of the responsibilities of staff members will do much to avoid or overcome problems arising from overlapping of duties. This harmony and order within the department is the first step towards similar attainments in relations with the many authorities, departments and individuals of our daily contacts.

Radiologists differ in the preference regarding technical results, and it is the duty of the Supervisor to adapt the technique to those preferences in order to avoid inconvenience and loss of time for the Radiologist in charge. The Graduate Technicians must give complete co-operation and assist in this way in the instruction of students, thus helping to avoid their chief problem — conflicting opinions among the department authorities. The wise supervisor, however, will instruct students well in the permissable latitudes of detail and contrast, various preparations and procedures, even while insisting on those preferred in that hospital.

In the small department, where the technician must also be bookkeeper, record-keeper, and stenographer, the problem of time-planning is no slight one, and only a technician with some versatility is prepared to handle this variety of work.

Where the amount of work warrants, a dictaphone is a decided asset, and in the case of a large and busy department, facilitates prompt readings and simplifies the work of the office staff, permitting definite time for the typewriting of reports, so that one stenographer may also act as admitting clerk and record-keeper.

* Paper read at Annual Refresher Course of the Nova Scotia Society of Radiographers, May 17th, 1946.

The problem of delayed reporting of hospital patients for their examinations and treatments may be overcome in the large department by employing aides for this work. Such helpers are also invaluable in caring for out-patients, conducting them to dressing rooms and preparing them for their examinations, thus saving the time of the technicians. In order to derive the benefits of the services of these subsidiary workers, however, a proper course of instruction must be given them, sufficient to impart understanding of the nature and extent of their duties.

Not the least problems of the X-Ray Department focus on the janitor or department maid. In this case, too, the size of the department and the help available tend to create wide variations in the plans followed. Cleanliness is essential. In the case of the small department the services of janitor or maids may be available only on certain days or during certain hours. When possible, particularly in the large department, the domestic workers should be hired for night duty, hours depending on the amount of work to be accomplished, not of course exceeding eight hours. In this way the department may be thoroughly cleaned without interruption by, or the interruption of, routine work.

Departmental difficulties with the staff doctors are chiefly those arising from vague requisitions, insufficient data, indefinite clinical histories. Detailed requisition forms with special note regarding the importance of clinical history may help in general. Otherwise those problems must be taken up with the individual doctors, the handling of which diplomatic matter doubtless will fall to the lot of the supervisor of the department.

Many of the problems of the X-Ray Department arise from strained relations with the heads of other departments of the hospital — and is there any department with which we do not have some degree of contact? Inter-departmental relationships will vary with the allotment of responsibilities by the individual hospital administration. In general, however, the X-Ray Department will have various degrees of contact with:

The Admitting Office where problems may arise regarding overlapping of appointments, etc., unless definite understanding exists.

The Pharmacy regarding the preparation of dyes, sterile solutions, routine supplies, etc.

The Diet Department when careful supervision of meals, lunches, etc., e.g., in Gall Bladder cases, is essential for the interpretation of x-ray findings.

The Clinical Laboratory, from which reports of significance should be available.

The Surgery, particularly the Fracture Room, which requires the services of technicians following surgical procedures, reductions, etc., and where valuable diagnostic plates may be lost through carelessness in returning same to the X-Ray Department immediately or where they may be destroyed by neglect to turn off the viewing light when not in use, since wet films may melt if left in lengthy contact with the heat of the high power bulbs.

The Obstetrical Department, from which co-operation regarding nursing service is essential when we are responsible for pre-natal examinations; also in radiography of patients in labor, and in this case, the Delivery Room Nurse should be in attendance.

Satisfactory arrangement must be made likewise with the Nursery if routine radiography of infants is required. (In our department the infants are brought to the Radiographic Room at 8.00 a.m. before the work of the day begins in order to assure the most aseptic atmosphere.)

The Nursing Department from which invaluable assistance may be obtained in procuring accurate and prompt carrying out of routine or special orders, and which can save our department much precious time and expense by such simple supervision as checking up on the removal of dentures, hair pins, etc., for patients requiring skull radiography, proper care of stretcher cases, removal of silk clothing, pins; the psychological approach in the preparation of all patients.

In addition to the diagnosis and therapeutic work of the X-Ray Department, there is another viewpoint regarding our responsibility to the Science of Medicine, and that is our educational contribution. Of what this consists, opinions will differ, but all will agree doubtless, that our contacts with the public, with the Hospital Administration, the Medical Staff, Internes, Graduate and Student Nurses, the X-Ray Department personnel, particularly student technicians — the public, all these contacts offer many opportunities for the dissemination of knowledge which should make a valuable contribution ultimately to the Community Health Programme.

In the maintenance of the X-Ray Department, we meet with problems of finance, repairs and modernization, efficiency in record-keeping, all depending again, on the plan of general organization.

In some cases the financial arrangement leaves the X--Ray Supervisor free of responsibility other than that of general economy, compatible with efficiency, and the highest standard of professional service. In some cases the department may be operated on a separate budget, and this system while satisfactory in many ways requires good executive ability in the Supervisor.

The problems of repair and modernization require vigilance and foresight. Prompt attention to necessary repairs pays satisfactory dividends in the saving of valuable time and materials, too often wasted in the attempted use of damaged fixtures or equipment. How much effort should be put into the modernization of our departments? The minimum is that required for efficiency, and one interest we perhaps do not develop sufficiently is that of making the department attractive. There is innate in human nature a love of beauty, and the most nervous patient will instinctively be attracted by the charm of colorful, cheerful waiting-rooms or dressing-rooms. In such an atmosphere, the tense attitude will unconsciously change and we all know that an infinitely better radiograph will be obtained on the relaxed subject. As for the various types of therapy, the same

mental attitude will be of material assistance by encouraging the patient to continue treatment, while a depressive atmosphere will, in many cases, result in the discontinuance of appointments. In all cases, good reading material should be provided in the waiting-rooms. In deep-therapy rooms, the characteristic odor accompanying the radiation has a distressing effect on most patients, and modern air-conditioning, with the obtainable odor-absorption devices is much to be advocated.

Correspondence, whether of a business nature, or pertaining to professional interests, should receive prompt attention. Co-operation should be given in the work of the various associations with which we may be connected even though it may contribute an additional secretarial burden. In the interests of the development of better standards of work and management of our departments, this should be considered part of our maintenance program.

Efficient record keeping in the X-Ray Department is no slight problem. The cross-index system will be found practical and is required in most of the larger institutions. Where a full-time record-keeper is not available, part-time service may be obtained, and some of this work can be accomplished in the evening. However, where the size of the department warrants, a full-time record-keeper is to be desired.

Public relations! Is there any department with the exception of the out-patient clinic, in more constant contact with so varied a representation of our public? Commercial firms, compensation boards, insurance companies, government departments, general practitioners, medical and surgical specialists, hospital clientele, out-patients, and by no means last on our list — the anxious relatives of our patients. Each of these classes presents its own particular problem.

With our commercial firms, satisfactory contracts, reasonable foresight in the placing of orders, prompt settlements according to arrangement, ordinary forbearance and courtesy in unavoidable delays of shipments, will do much to establish friendly relations and procure the best possible service.

With our various benefit agencies, accuracy on our part in completion of forms will be our share of the co-operation needed, for not the least of our difficulties come from receiving in these as well as all other cases, incomplete data for our own files.

Our good doctors, of course, in the busy rush of general and specialized practice, are frequent offenders by giving only verbal orders, not being explicit regarding region of examination, providing no clinical history, etc.

Our hospital patients, being directly under the supervision of hospital staff, are seldom responsible for the problems in which they are involved, but out-patients may fail to co-operate in following orders, unless we give explicit directions, or better still, have printed orders for the preparation necessary for examination they are to have, and stating precisely the time of reporting at the department. We may prevent many of the problem cases of out-patients regarding nervousness, by the "first impressions" we make, either by telephone or interview, when

making the appointment. Even more problematic may be the anxious relatives, and with these we must be sympathetic, courteous, tactful, even in the rush of our busiest days.

Our professional associations have been most active during the past few years, developing the best interests of our science and art, and we may receive great assistance in the solving of our problems by regular attendance at the local or regional group meetings. Refresher courses are not to be passed over even by the most experienced technicians, and we should do all in our power to contribute to the success of any course, conference, or program undertaken by any of these associations.

In the final analysis, the solving of our problems falls to the lot of the individual supervisor, or technician. The usual reports required of all departments should be made to the radiologist or the superintendent of the hospital, at stated intervals, according to the customs of the hospital, and an immediate report should be made of any unusual situation, particularly one arising from inter-departmental friction, or strained public relations.

The management of an X-Ray Department, large or small, indeed involves many problems, but solutions will be found, practical solutions for difficulties involving trivial complexities and high ideals — for we must keep our ideals high — "*usque ad astra.*"

Who's Who in the C.S.R.T.

We hope, if we can obtain enough photos, to run a series of pictures and short biographies of the more prominent personalities in our Society, so that when members meet them they will feel that they know them, at least to some extent. The Editor would appreciate the help of the members in continuing this series.

Here, then, is the first of the series, our President for 1946-7, Mr. P. E. Hunt, of Saskatoon.

"Persse" Hunt is well known across Canada as an enthusiastic and energetic worker for the C.S.R.T., as well as an outstanding technician. For the past 25 years he has been a radiographer with the Saskatchewan Anti-Tuberculosis League and has written a number of noteworthy articles on radiographic technique. His duties, first as a Sub-Editor of The Focal Spot, then as Secretary-Treasurer of the C.S.R.T., and now as President have brought him into contact with fellow technicians in all parts of Canada, often personally, sometimes by correspondence, and all retain an impression of his great sincerity and of his desire to devote himself to the limit for the improvement of the Society of which he is now President. In this purpose he is supported by the unswerving loyalty and downright hard work of Mrs. Hunt, who serves as secretary and typist for the never-ending correspondence which his position entails. The Society appreciates Mr. Hunt's energetic work as Secretary-Treasurer and knows that he will continue his effective leadership as President.

Travelling Tuberculosis Clinics North of the 53rd Parallel

By ARTHUR E. CLIFFE, R.T.
Clearwater Lake Hospital, The Pas, Manitoba

MUCH different to the Travelling Clinics south of here, we have other worries — chiefly transportation, and with transportation goes fine weather, for a lot of our clinics are reached by air.

Good roads stretch north from The Pas for little more than twenty-five miles, so a big four-wheel trailer would be of little use to us at the present time. These roads either come to a dead end or narrow off to a rough bush trail. For instance, in the town of Sherridon, which one can only comfortably reach by either train or aeroplane, there is a total of only five miles of road—stretching for three miles in one direction and two in the other. By road, they are not connected with the southern areas of Manitoba at all.

We have quarterly clinics at The Pas, Flin Flon, and Sherridon, going to one of these places each month. At present this comprises our "white-clinic" work. Quarterly clinics are comparatively light with less than one hundred patients in one place, each time we go. Also in all three places there is an annual survey. These are usually "steady grinds." In Flin Flon during September we did a survey of high-school children, food-handlers, and referred cases by local doctors — a total of over eight hundred patients. At times we averaged as high as one patient per minute on the 14x17 and 10x12 size of film. Considering the time that it takes to change cassettes, etc., I figure that this is a fair rate. We take along only 14x17 and 10x12 size films and four cassettes in each size so that a minimum of time is wasted between the x-ray machine and the dark room.

Our x-ray machine is the Picker built U.S. Army field unit which, when packed, fits into three metal trunks apart from the transformer. Altogether, I would say that it weighed approximately 650 lbs. For outlying districts only, where there is no power, we carry our own power supply to operate the x-ray machine. It is the heaviest box of the lot as the lid carries a well equipped tool chest attached to the inside. It weighs between 350 and 400 lbs., and is a unique piece of apparatus in that it was made only to operate the U.S. field unit and therefore turns out the most efficient wave-form of electricity for the x-ray machine.

At this point I should mention that weight has a direct bearing on our mode of travel as far as outlying districts are concerned. To get to our quarterly clinics, weight has no bearing because we go by C.N.R. For outlying districts, however, we can only take so much weight by 'plane.

We use the Lamb Airway's MK V. Norseman to set us down in places like Guy Indian Residential School at

Sturgeon Landing or the St. Joseph's Indian Residential School at Cross Lake. Sturgeon Landing is approximately forty air miles from here and can be reached by plane in twenty minutes from the airfield here at the hospital. Cross Lake is approximately one hundred air miles away and takes an hour or more to travel. Fortunately the base on which this hospital is situated is an airbase that was operated by the United States Army during the war and whose airstrips (according to engineers) will last for many years to come. So planes take off on Travelling Tuberculosis Clinics in this case from practically the hospital door-step. To date, we have only travelled by air in the winter time with ski-equipped aircraft, but Clearwater Lake being less than a quarter of a mile away would make a handy means of take-off with a pontoon-equipped aircraft during the summer months.

It is expected that added clinics to Island Lake, Grand Rapids, and Pelican Narrows will materialize this coming summer. Tuberculosis seems to be more prevalent in these three places than on most other Indian Reservations north of the 53rd parallel.

Now for the adventurous side of Travelling Clinics. Sturgeon Landing Clinic would have taken place before dinner on February 7th but for a strong ground wind which prevented us from taking off before noon. The equipment was transferred from the hospital to the airfield by ambulance. Everything fitted so neatly into the cabin of that red Norseman with the "Lamb" coat-of-arms painted on the fusilage. Tom Lamb himself was pilot and while he helped to load his proud "ship" he spun yards galore with us.

Dr. R. F. Yule came out from The Pas in the plane so he stayed seated in the front beside the pilot. Dr. J. M. Ridge sat directly behind on the generator box and I huddled myself in the rear on top of the other equipment to keep warm. This was a more or less historical event for it was the first known complete x-ray and examining Travelling Tuberculosis Clinic that had taken off by air in Canada.

We flew low, between 600 and 800 feet. (Tom Lamb is great for wanting to see the wild life on the ground below at close range.) We even had a few miles of low ceiling on the way. The general thought was that we were flying too low (at least from the "back-seat riders"). If something should happen with this load we'd certainly be well abrased from the jack-pine below. I looked down and wherever there were no lakes there was sure to be jack-pine. Explained to me was a meter on the panel board registering manifold pressure. It was reading "25", but if perchance it should reach "35" we'd only have another minute and a half in the air. Incidentally, I was "all ears" as it was my first flight. I don't think I scare easily though.

Plainly seen from the air was the winter tractor-road in from Atik, on the Flin Flon Railroad, to Sturgeon Landing. This road is only used in winter, utilizing the ice on the lakes to cross country in a more direct route. At one particular place, six moose ran under the pines below when they heard the plane approaching. The whole ground below was like one big mud-hole in many places.

Guy School is situated on the borders of Manitoba and Saskatchewan at the mouth of the Sturgeon-weir river as it empties into Sturgeon Lake. A fair sized Indian Reservation surrounds it.

The plane landed on the lake and proceeded up the river-mouth in front of the school. The principal and a number of the older "braves" were down with the sleigh and horses a few minutes after we had landed, to help transfer the equipment to the school some three hundred yards off.

The clinic was held on the second floor of the building where a suitable dark-room was found close at hand in a clothes closet. For once the odor of moth balls in this closet prevailed over the usual odor of tanned leather that one quickly detects when working with Indians. The children were very well dressed and clean though.

We were able to get a few chest films taken before supper-time where the centre of attraction lay in an artistically designed table made by one of the staff. I had never seen a table like it before. It had two tiers, of which the upper tier revolved on a pivot to save passing at the table. The revolving tier, though a little smaller in diameter than the larger one directly below it, contained all the food and partakers of the meal eat from the lower tier.

Dr. Ridge and I worked that evening until 11.15 x-raying all the students and staff before turning in for the night. When finished, we enjoyed a midnight snack at the round table. Tom Lamb was returning for us the following morning and we would only have time to pack the machine before he arrived.

That night Dr. Ridge slept in the archbishop's room, Dr. Yule in a small room close to the dispensary, and I had a whole hospital ward to myself. We were dead tired and I didn't hear another sound until I heard prayers going on in the room below me the following morning.

We had breakfast before packing, which took up most of the time before the plane was heard circling the school again. That was at 9.00 a.m. In the meantime we went from one school room to the other saying "Hello" to the students and looking over their work and progress. As we went into the class-rooms they would all stand up beside their desks and in a loud monotone, say "Good morning, Doctor." In some rooms they sang a song for us in either English or Cree. Some of the girls take courses in sewing, knitting, and embroidery work to enter in large town fairs such as Brandon. Some of their work is really wonderful and wins top prizes at these fairs.

The Cross Lake Clinic was very similar to the one at Sturgeon Landing. Our pilot this time was Jack Hone a pilot for the Lamb Airways and ex-ferry command pilot for the R.C.A.F. of World War II. He flew at mostly 5,000 feet all the way. Visibility was excellent during that hour in the air and Lake Winnipeg could be seen almost fifty miles away beyond that prevailing northern muskeg.

That evening there was an old style picture-show at the school. It is some time since I have gone to a show and had somebody reading aloud what was on the screen. From this you will gather that it wasn't a "talkie," but it was a change to see a silent picture again. Before going to the show though, we went scouting around for beadwork, for it is said that Cross Lakers produce some of the finest beadwork of all the northern reservations.

The following day we were supposed to return home but the ceiling was zero and it was trying its darndest to rain. The plane returned to get us, but was barely more than hedge-hopping the

tree tops. We waited around all that day for better weather and did not get away until that evening at six. During the day to put in time we set up our x-ray machine again and x-rayed an extra twenty-five patients from the reservation.

The clinic up the Hudson Bay Railway was not a flying trip but one by gas-car and a flat-car trailer hooked on behind to carry the x-ray equipment. As a boy I had always paid a great deal of attention to the local section-man in our town and thought how swell it was to be travelling around on a "jigger" to work, but I had enough of it on this trip. The gas-car belongs to the R.C.M.P. detachment in Wabowden and was operated by Corporal Moore himself. Others on the trip were Dr. A. L. Jacobs, Dr. J. M. Ridge, Lloyd Williams, the sanitary inspector; James Menzies, Manitoba medical student, and myself. We held clinics at six centres along the Hudson Bay Line in the week, taking over seven hundred films. We set up in town halls, Sunday schools, and private homes and in most places had to construct a complete darkroom from blankets.

It was in the end of May when we went on this trip and Jim Menzies and I went dressed the way we would for the climate at home for that time of year, but before we returned had even used tarpaulin covers from the equipment to wrap around ourselves to keep warm. The closer we got to the Hudson Bay (and we only went to Gillam) the colder the icy winds were from the direction of the Bay.

Twenty-five miles this side of Gillam we were clipping along at 25 to 30 miles per hour when the inside rim of one of the front wheels wore off and we had to come to rather an abrupt stop. So Jim and I walked back three miles to ask the assistance of the local section foreman. By the time we got to Gillam we had been towed by two other gas-cars. At Thicket Portage our generator required about three hours' maintenance work from the rough ride and we almost thought that the whole trip had ended then and there. With the help of a few mechanically minded personnel though, we were able to get is repaired and proceeded with the clinic.

We usually travelled by night and travelling time almost equalled working time for the whole trip. The hotel accommodation was very good but at Ilford the hotel had not opened for the season, so after arriving there tired at 3.00 a.m., we had to hunt up the hotel proprietor a few doors down the street before getting into the hotel. No beds had been made as the building was standing as it had been left the preceding autumn, so we just rolled our bed-rolls out on the floors of our rooms or some of us rolled them out on the bed-springs.

The next day it was difficult to make some of the Indians realize that they were to come to be examined at our clinic. In fact, some of them just didn't come until Corporal Moore went away into the bush to scare them all out. With this help our clinics were usually 100% in attendance.

So with this paper, I hope I have made things interesting in telling you both the exciting and routine parts of Tuberculosis Clinics north of the 53rd parallen. Up here there is a very much needed and worthwhile job being done and when one sees the good results that come from it all, we know that the work is not all in vain.

Dark Room Facts

By A. F. MUIRHEAD, R.T.

Montreal General Hospital (Western Division)

CONCERNING the real value of an x-ray film, I am of the opinion that the average technician does not give handling and processing sufficient care. Some think, when they have taken the temperature and set the clock, that is all there is to do. Processing becomes a purely mechanical act, instead of something of real interest. After all, it is in the dark room, during development, that one really sees the result of his or her skill and knowledge come into view. A technician who spends valuable time in perfecting technique should use a little more thought and intelligence in the dark room. When a finished film turns out contrary to expectations, the technicians should be interested enough in their work to find out the real cause of a poor film; whether the fault is technique, or dark room. When one thinks of the value of a radiograph, what it can mean to suffering humanity, to the Radiologist, and finally to the technician, the knowledge of having created something worth while is realized.

One of the greatest factors in a dark room is cleanliness. Considering the sensitive emulsion with which a film is coated, it is easy to understand that extreme care in handling should be used.

Films are affected by x-rays, light, heat, moisture, static, scratching, abrasions, and contact with the fingers. Never handle films with moist fingers, or which have been contaminated with chemicals. When handling films keep them flat, or marks will show on the developed film. Do not draw the films rapidly from the cassette or folder. This causes a static electrical discharge which will result in dark markings on the developed film.

Great care should be taken not to contaminate the soultions, one with the other. Nothing stains films quicker. If the fixing solution should in any way drain into the developer, a green greasy looking scum will form on the developer, which will stain the films. This stain cannot be washed off.

The rinsing water between the developer and fixing bath should be kept clean. If this water becomes dirty and is drained into the fixing solution, the life of the fixer is shortened. Sufficient fixing is absolutely necessary to preserve the life of a film. Insufficient fixing will result in the fading of the photographic image.

Care should be taken to use enamel pails for mixing solutions. Never use galvanized iron pails. Metals such as tin, copper or zinc should not come in contact with processing solutions.

The dark room, accessories and equipment should be kept clean and

used only for the purpose for which they were intended. Develop films according to temperature, rinse from five to ten seconds, fix for ten to fifteen minutes, and wash in running water for twenty to thirty minutes. To save the solutions drain films well before transferring from one tank to another. The films should not be too crowded in the tanks. This will cause the films to stick together, and leave a stain which cannot be removed.

After the films have been removed from the hangers, do not pull them across one another before the corners have been trimmed. This will cause bad scratches. Another way to scratch wet films is by Tom, Dick or Harry pulling the films out of the tanks when searching for a film. If one would find out the size of the film which has been used, a lot of time and grief would be saved.

Faulty treatment of the film may produce errors and blemishes in the finished radiograph, which are frequently overlooked, such as grey fogging, caused by over exposure or scattered x-rays, a faulty dark room lamp, or from careless and excessive exposure of the film to the lamp; too frequent removal of the film from the developing bath to the air.

Yellow fogging is caused when developing has been carried on too long, or the developer is old and exhausted.

Careless handling of the films can produce half moons, or thumb marks, which often have the unhappy habit of appearing on the most important spot, thereby spoiling the result.

Take care of the cassettes and screens, keep them clean. Do not use a pencil near an open cassette. If at any time you have to write on a film, lift it out of the cassette. Pencil marks can do a lot of damage to the screens.

Round white and sometimes wholly transparent spots are due to bubbles of air which have become attached to the surface of the film and have prevented the action of the developer on this particular spot. The creation and attachment of air bubbles can be avoided by agitating the film on the hanger once or twice before it is finally left in the developer.

Finger marks, light or dark sharp-edged spots are due to the film surface having been touched with unclean fingers, or else to the presence of splashes of other chemicals. Drops of developing solution produce very dark spots, while those from the fixing solution cause transparent blemishes. Even drops of water which are allowed to fall on the developed film will appear as dark spots or streaks.

These are a few pointers on dark room work which it is absolutely necessary to observe if brilliant films are to be the final result.

The Focal Spot

Journal of the Canadian Society of Radiological Technicians

EDITOR
LESLIE J. CARTWRIGHT, R.T.

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"All our ambitions should be devoted to a faithful fulfilment of duties towards others as well as to ourselves."—Roentgen.

EDITORIAL NOTES

PROCEDURE FOR OBTAINING R.T. CERTIFICATE

Membership certificates are expected to be delivered by the engraver at any time now. These will be sent to the Registrar, Miss Katherine Creelman, City Hospital, Moncton, N.B., who will have the hand lettering of members' names, dates, etc., executed. The various provincial secretaries have already forwarded to the Registrar lists of members entitled to receive certificates as Registered Technicians in the C.S.R.T. So the procedure now is for these qualified members to write to the Registrar, stating the way they wish their names to appear on their certificate, their date of qualification and also whether they wish an English or French certificate. It will also be necessary for them to enclose with their application the registration fee of one dollar. This registration fee may call for an explanation. The production of two engraved certificates — one in English and one in French — is rather an expensive proposition, particularly so in these days of advancing costs. Your Executive was faced with two alternatives — getting a less expensive printed certificate or adhering to their original intention of producing a copper-engraved certificate which members would feel proud to hang on the wall of their x-ray room. Their feeling was that the membership as a whole would prefer to pay a small fee and have the superior article. Hence the dollar registration fee.

The length of time it will take before members receive their certificates is chiefly dependent upon how long the engrosser takes to letter the individual documents. In the meantime it would be as well for members to send in their applications right away as it will be a case of first come, first served.

FRENCH LANGUAGE CERTIFICATES

It is particularly requested that members of the C.S.R.T. desiring their certificates in French should notify the Dominion Registrar at once that they wish them in the French language, as it is necessary for us to know how many to order from the engravers. To date the Registrar reports that she has had no applications for French language certificates.

DOMINION REGISTRY

It is possible that a Dominion Registry will be published before long and as the lists referred to above will be used in its compilation, this is an additional reason for making sure your name is on the Dominion Registrar's list.

RESOLUTIONS COMMITTEE

Mr. Herbert Welch reports that no resolutions for consideration at the next annual meeting have yet been received and would appreciate member societies who have proposals to make to bear in mind that resolutions should be submitted in time to be published in The Focal Spot before the convention. Remember there are only two more issues before the convention.

ONE MORE CHANCE FOR FOCAL SPOT BINDERS

The response to the suggestion of Focal Spot binders has not been good enough. No doubt the Christmas season had something to do with this. Money was needed for other things and apart from this angle the Christmas season probably caused many to forget the matter altogether. We need about four times as many paid-up orders as we have at present to put the matter through, so we have decided to keep it open for a month after the publication of this January issue.

If by that time insufficient orders have come in to make it worth while we shall have to reluctantly drop the idea and return the money to those who have remitted it. We feel that the idea is a good one and that the majority of readers would like to have their journals filed conveniently, but with the unfortunate weakness which afflicts so many of us of putting things off till a more convenient time, they just don't do anything about it. So here is the last call for binders —if you want one fill in the order form from the October issue and mail it with $2.00 to the Business Manager, Mr. Hugh J. Menagh, 67 College St., Toronto, Ont., or if you have lost the form, just write a note giving your name and address clearly. If this proposition falls through from lack of support it is hardly likely that we will trouble to revive it for some time.

News Items from the Provinces

continued from page 4

NEW BRUNSWICK

Miss Creelman, President of the New Brunswick member society and our official delegate to the Niagara Convention, delivered a well prepared report of the Annual Convention.

Following the business meeting, delicious refreshments were served by Miss Creelman, after which the members were invited to visit the x-ray department before departing for their homes. All present voted this a pleasant and profitable meeting and expressed the wish that more members would make an effort to attend their meetings.

Sr. M. de Lellis, of St. Joseph's Hospital, Saint John, N.B., is taking advanced studies at St. Louis University, Mo., leading to a degree of B.Sc. in radiologic technique. Miss Jean Stuart Bellis has accepted a posiiton on the technical staff in the x-ray department during Sr. de Lellis' absence.

—J. RUSSELL MORSE, R.T.,
Sub-Editor.

NOVA SCOTIA SOCIETY OF RADIOGRAPHERS

The regular monthly meeting of the Nova Scotia Society of Radiographers, Halifax District, was held in the Halifax Infirmary on Wednesday, 13th November, 1946, at 7.30 p.m.

In the absence of the President, Miss Harley, Mr. Albert Perry presided.

The meeting got under way with Mr. Norman Hurst from the staff of the Victoria General Hospital, Department of Radiology, being the speaker.

Norman is always a drawing card and should any fail to gain a new tip or pointer, they had far better remain at home. With Norman, one feels at home immediately; his calm and cool manner relax one and on this occasion we caught him at his best.

His subjects, tips and extra positions were outstanding, and to make it doubly interesting, he made radiograms to force home his points.

Acromio-clavicular articulation was quite new with angulation of the tube, also the clavicle.

A.p. views of the optic foramen and zygomatic arch — possibly you may have read his article on some of these, all of which are most interesting, constructive and educational. You would have to see Norman at work and his results to appreciate his ability; he is a fountain of knowledge, a born teacher and instructor.

—A. PERRY, R.T.,
Sub-Editor.

CAPE BRETON SOCIETY

A re-organization meeting of the Cape Breton Society of Radiographers was held in connection with the Regional Hospital Meeting in Sydney on September 29th, 1946.

The following officers were elected:

Honorary President
DR. H. B. CORBETT

President
MR. MURDOCK MacLEAN, R.T.
City Hospital, Sydney

Vice-President
MRS. GRETA MacPHERSON, R.T.
City Hospital, Glace Bay

Secretary-Treasurer
MISS GRACE DAVIS, R.T.
City Hospital, Sydney

Publicity Chairman and Sub-Editor
SISTER JOHN OF THE CROSS, R.T.
St. Joseph's Hospital, Glace Bay

We were very pleased to have Dr. Corbett with us at this meeting and hope to make good use of the advice and gems of wisdom which he so willingly gives us. We feel we can make use of it all, as we are planning to have a Refresher Course sometime in May. A Refresher Course, as we all know, entails plenty of hard work and planning. Let us all work together to make this one the best yet.

—SISTER JOHN OF THE CROSS, R.T.,
Sub-Editor.

ONTARIO SOCIETY OF RADIOGRAPHERS

EASTERN SECTION

A meeting of the Eastern Section of the Ontario Society of Radiographers was held on Saturday, November 16th, at the Manitonna Hotel, Brockville.

At the short business meeting two officers were appointed — subject to the approval of the Executive Committee — Miss C. McIntyre, M.O.S.R., Medical Arts Building, Ottawa, Chairman; Miss B. E. Blair, R.N., M.O.S.R., Civic Hospital, Ottawa, Secretary.

Two very interesting papers were given.

"X-Rays in Pregnancy from the Obstetrician's Point of View," by Dr. Robertson of Kingston.

"X-Rays in Pregnancy from the Technician's Point of View," by Miss Clarke of Kingston.

Each had special films to demonstrate their points.

The next meeting in this section will be held in Smith's Falls.

—BEATRICE E. BLAIR, R.N.,
Sec'y., Eastern Section.

CENTRAL SECTION

The first meeting of the Central Section will be held at the Royal York Hotel on February 1st, 1947, at 7.30 p.m., in the Roof Garden.

Your committee has arranged a programme which we think will be one of our best.

7.30- 8.00 p.m.—Dr. G. C. Brink, Director of X-Ray Chest Services, Ontario Department of Health.

8.15- 9.00 p.m.—Dr. H. S. Coulthard, Toronto Hospital, Weston, Tuberculosis of the Bone.

9.15- 9.45 p.m.—Interesting and unusual films presented by the Technicians.

9.45-10.00 p.m.—Meeting to elect a new Chairman.

10.00 p.m.—Buffet Lunch and Refreshments. Registration Fee $1.00.

There is to be a new chairman for this section appointed at this meeting. Your committee would like a few volunteers for this position. Please send your name to the Secretary a few days before the meeting.

—J. H. GUTHRIE, R.T.,
Chairman.

QUEBEC SOCIETY OF X-RAY TECHNICIANS

The Province of Quebec Society of X-Ray Technicians held its second meeting of the season at the Ste. Anne's Military Hospital on Saturday, November 30th, 1946. Miss D. Campbell presided, and there were thirty-two members and four guest speakers present.

The President opened the meeting by introducing Dr. G. T. Adams, Radiologist at the Military Hospital. Dr. Adams welcomed us to Ste. Anne's on behalf of Dr. Laplante, who was unable to be present.

A most interesting and instructive address was delivered by Dr. Adams. His talk on Radiography of the Skull was illustrated with actual radiographs of the Skull, Mastoids and Sinuses. A French translation was given by Dr. Mayeux. Thanks were expressed to Dr. Adams by Miss Harris and to Dr. Mayeux by Sister Margaret de Jesus.

While the members of our society enjoyed tea and sandwiches, Mr. Baker, Mr. Daniels and Mr. Brochu, Technicians at the hospital, gave our technicians many valuable hints on positioning and technique.

The members enjoyed a visit to the spacious and well-equipped X-Ray Department; the majority feeling a little envious of the equipment and darkroom facilities.

Miss Cameron, Physiotherapist at the hospital, very kindly came out from Montreal especially to conduct us around the Physiotherapy Department. She gave us all a clear and concise description of the various types of equipment and treatments being given to our veterans.

The members returned to Montreal by Provincial Transport Bus, with the feeling that the afternoon had been both enjoyable and instructive.

Meetings of the Executive have been taking place to study the situation of training of students and a curriculum has been drawn up. Several other matters concerning Regis-

tered Technicians have yet to be discussed and I hear a meeting is called for next Friday evening.

Here's hoping that before 1947 ends, a well-formed course of lectures will be on its way.

Shortly before Christmas, the members of the X-Ray Department of the Montreal General Hospital had the pleasure of meeting Mr. Percy Ghent of Toronto, who was on a short visit to Montreal. Another visitor to our department was Dr. Charles Jones, now Radiologist at the Halifax Infirmary, who some years ago received his training as a Radiologist from Dr. W. L. Ritchie.

I had a short chat with Dr. Jones and enjoyed going over some of the experiences we had together in the Montreal General Hospital.

—ROSEMARY O'HAGAN, R.T.,
Sub-Editor.

SASKATCHEWAN SOCIETY OF X-RAY TECHNICIANS

SASKATOON SECTION

The Saskatoon group of technicians held their October meeting in the City Hospital on November 17th, Miss Phyllis Unchman in the chair.

The following were contributors to the programme:

"Pelvimetry", Dr. Spencer, Radiologist, St. Paul's Hospital.

"Radiography of the Knee with the Injection of Air," Mr. George Jackson, Technician, City Hospital.

"Anatomy," Mr. George Derrick, Technician, St. Paul's.

Mr. Jackson reported on the recent Dominion Convention.

Mr. P. E. Hunt gave the meeting something to ponder over when he gave an outline on the amount of work to be done by all if the 1947 Convention, to be held in Saskatoon, is to be as successful as previous ones.

The November meeting took place in the Saskatoon Sanatorium with Miss Unchman as Chairman.

The programme was as follows:

Mr. Hunt, "X-Ray Physics, the Filament Circuit."

Mr. G. Jackson, "Radium Experiments."

Mr. G. Derrick, "Anatomy."

Mr. Jackson gave a report on the Regina meeting.

Lunch was served and a pleasant evening came to a close.

REGINA SECTION

The regular monthly meeting of the Regina sectional members of the Saskatchewan Society was held in the lecture hall of the Regina General Hospital on Sunday, November 10th, 1946. This meeting was well attended, one technician coming over two hundred and fifty miles, while six technicians, including Mr. P. E. Hunt, the Canadian Society President; Mr. George Jackson, and Miss M. Perron, the Saskatchewan Society President and Secretary respectively, came down from Saskatoon.

The meeting was a very successful one and an interesting programme, convened by Miss Angelle Pantelle, was enjoyed by all. Following an address of welcome by Miss Pantelle, a talk on the advantages of belonging to the Saskatchewan Society by Mr. Hunt was very stimulating.

Mr. G. Jackson then gave some interesting facts concerning the recent convention at Niagara Falls, telling us what the Society has done and what it intends to do in the future.

Next was a short talk on exposure factors by Mr. S. G. Johnston of Moose Jaw.

Then Mr. Jackson gave us a few pointers on positioning for radiographing the knee joint.

Dr. L. C. Hacking, Radiologist to the Regina General Hospital, chose the subject of Intravenous Pyelography, tracing the methods used in the past down to the present and illustrating his talk with films taken with and without compression aids. Dr. Hacking

showed us some gadgets which he had designed himself for the purpose of compression without casting a shadow on the pyelogram or urogram.

An address by Dr. A. E. Perry, Radiologist, Grey Nuns' Hospital, Regina, entitled "The Life of Roentgen," illustrated with slides, was enjoyed by all.

This concluded the programme insofar as business and educational matters were concerned, but this was not all, for after adjournment we were conducted to the comfortable reception room of the Nurses' Residence, where a dainty lunch was served by the technicians attached to the hospital. We would like to thank the Medical Superintendent, Dr. Baird, for the kind courtesy extended to visiting technicians and for the accommodation for this most interesting meeting.

We feel that when Radiologists, busy as they are, are willing to give their time in the interests of technicians, our Society is bound to prosper, and we its members greatly appreciate their helpful co-operation.

The next meeting will be held in January, 1947.

The Secretary, Miss Perron, informs me that the members of the Saskatchewan Society now number seventy-five, but Mr. Jackson, the President, and Miss Perron are still not satisfied and in the near future intend to commence another drive for new members who are eligible.

—S. G. JOHNSTON, R.T.,
Sub-Editor.

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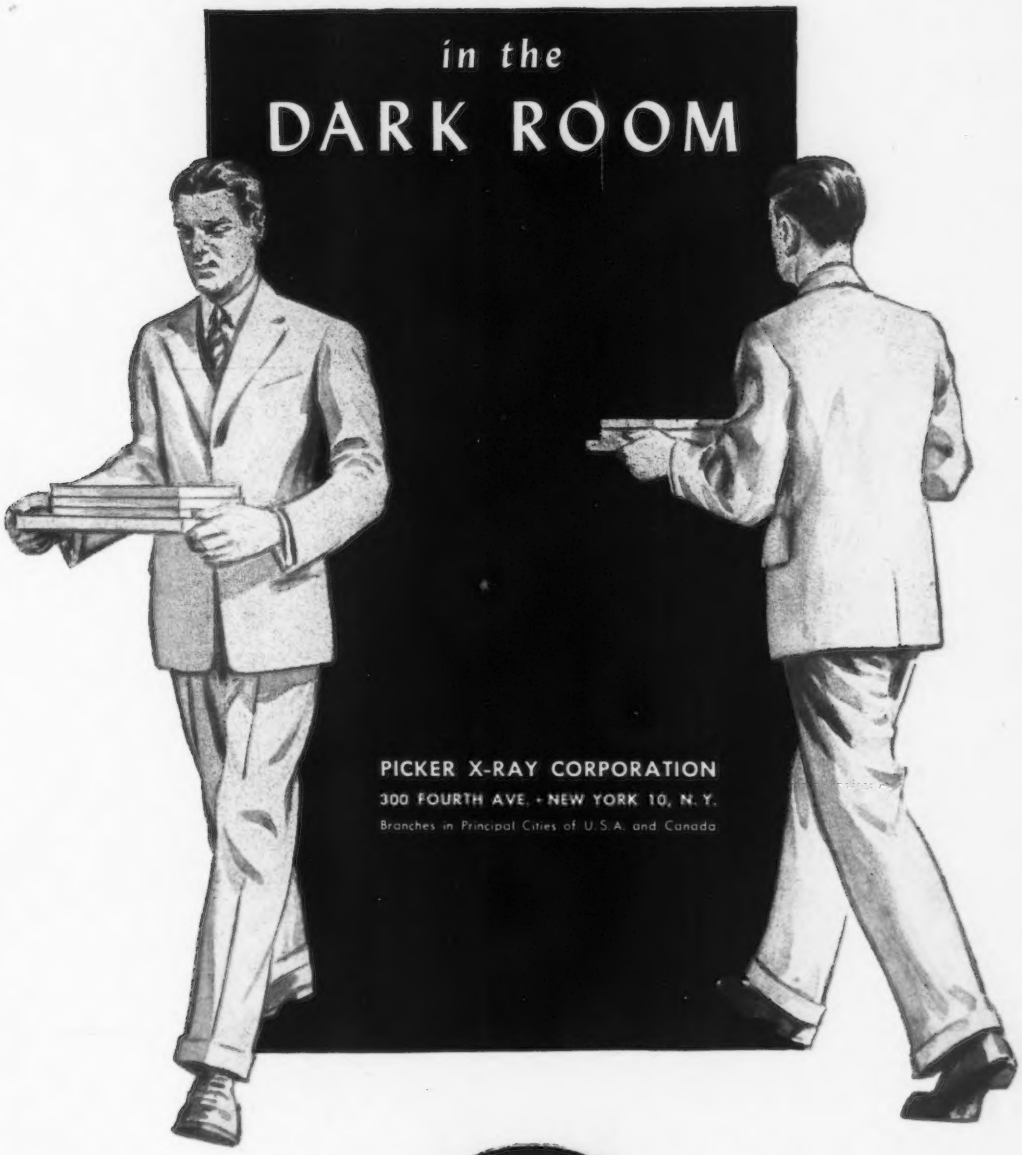

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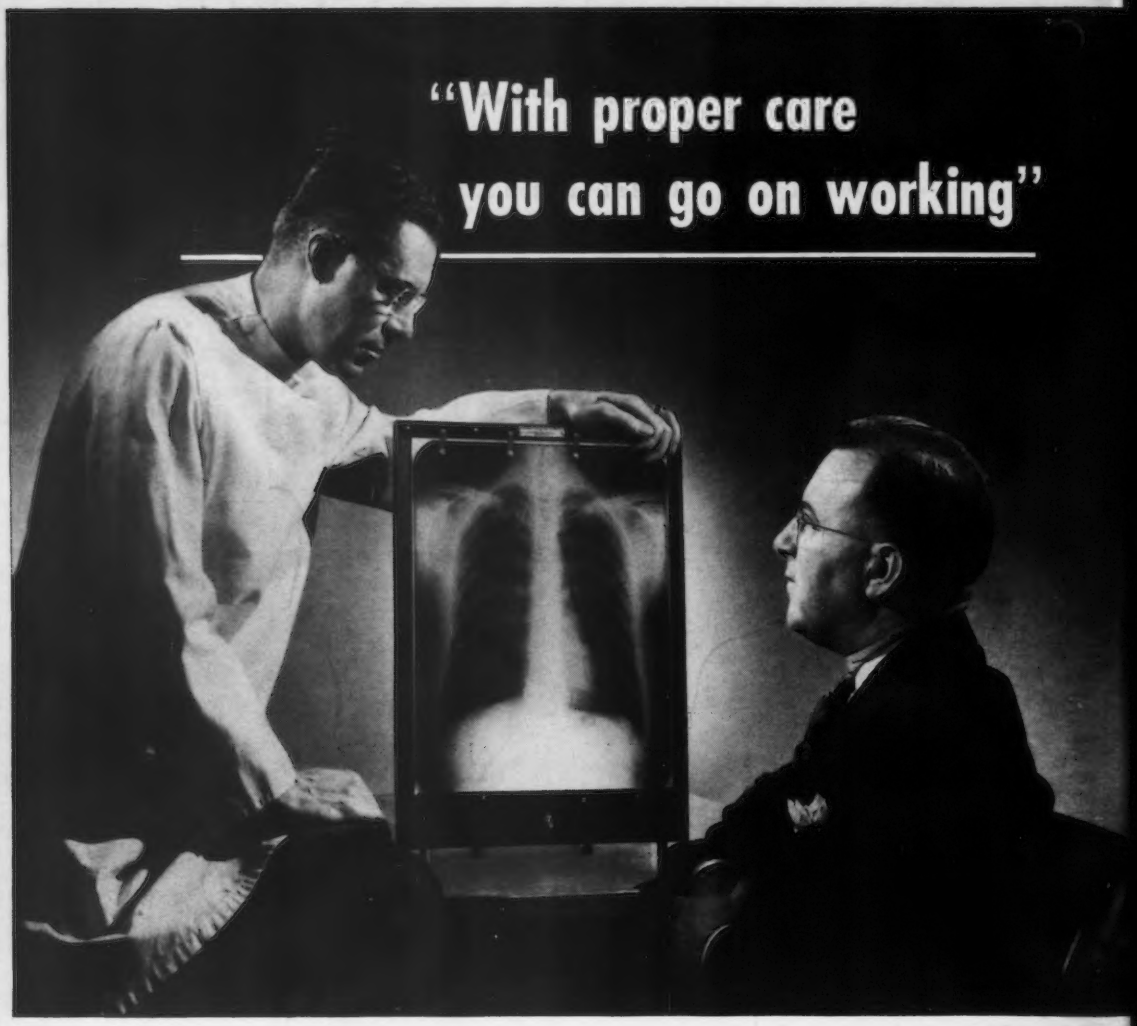

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